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WOOD WASTE GENERATION AND MANAGEMENT IN ONTARIO

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EXECUTIVE SUMMARY

This report identifies major wood waste generators in Ontario, the amount and type of wood waste they generate, and the ways in which this wood waste is managed. From these data, estimates are made of the total amount of wood waste generated in Ontario, the amount reused, recycled or recovered for energy value, and the amount discarded in landfills or burned outdoors.

A questionnaire was used to identify the major wood waste generators in southern Ontario, the type and quantities of wood waste generated by each generator, current wood waste management practices of each generator, and the costs associated with wood waste management. The questionnaire was prepared and sent to sawmills and related mills, secondary forest products industries, other manufacturing industries with greater than 500 employees, municipalities, National and Provincial Parks, conservation authorities, waste management companies and demolition companies. In addition, existing data on wood waste generation by the above sectors and the construction, demolition and commercial landscaping industries has also been used.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Estimates of wood waste generation in northern Ontario have been based on available data on wood waste generation by the primary forest products industry, together with data pro-rated to reflect northern Ontario based on the southern Ontario data base.

Potential for improved wood waste management practices is illustrated with five case studies.

It is estimated that 2.147 million bone dry tonnes of wood waste were generated in southern Ontario in 1988. An estimated 0.845 million bone dry tonnes of wood waste were generated in northern Ontario in that year. Total wood waste generation in Ontario is estimated at 2.992

million tonnes in 1988. These data are summarized in Table ES.1.

Wood waste reutilization initiatives are common among many wood waste generating sectors. In southern Ontario, an estimated 0.912 million bone dry tonnes (42 percent) of generated wood waste were reutilized in 1988; the corresponding figure for northern Ontario is estimated to be 0.658 million bone dry tonnes (78 percent) of wood waste generation. In total, 1.570 million bone dry tonnes of wood waste that were generated in Ontario in 1988 are estimated to have been reutilized in 1988, representing 52 percent of wood waste generation. The remaining 48 percent of wood waste estimated to be generated in Ontario, amounting to over 1.4 million bone dry tonnes, is discarded without reutilization. These data are summarized in Table ES.1

Significant opportunities exist to enhance wood waste reutilization. In order to contribute to the greatest extent possible to the Ministry of Environment's goal of diverting 25 and 50 percent of waste from disposal by 1992 and 2000 respectively, however, efforts to enhance wood waste reduction activity need to be coordinated into a strategy and action plan that has the support of all key stakeholders. The recommendations that follow describe how this should be achieved.

Recommendations

The recommendations that follow are divided into strategy and policy recommendations, and those that pertain to specific types of wood waste or specific categories of wood waste generator.

Strategic and Policy Recommendations

1. The 3Rs hierarchy is as relevant for wood waste management as for the management of other wastes. This hierarchy of management priorities represents an environmentally sensitive management philosophy, advancing towards sustainable development. This hierarchy should therefore be applied to wood waste management options.

Table ES.1

Summary of Wood Waste Generation
And Management In Ontario

	Wood Waste Generated (000's BD tonnes)	Wood Waste Reutilized (000's BD tonnes)	Proportion Of Wood Waste Reutilized (%)
Southern Ontario	2147	912	42
Northern Ontario	845	658	78
Total:	2992	1570	52

2. The Ministry of Environment, together with the Ministry of Energy, should immediately stage a conference targeted at wood waste generators and users to communicate the findings of this report and to explore possible directions and actions to increase wood waste reutilization.

3. Following the conference proposed in Recommendation 2 the Ministry of the Environment together with the Ministry of Energy, should create a multi-stakeholder Task Force on Wood Waste Reutilization. The Task Force should consist, at a minimum, of representatives from the Ministry of the Environment, Ministry of Natural Resources, Ministry of Energy, Ontario Hydro, municipalities, the principal wood waste generating industry sectors, consumer groups and environmental groups. Within six months of formulation, the Task Force should present to the Minister of the Environment and the Minister of Energy a "Strategy and Action Plan For Wood Waste Reutilization in Ontario" that represents actions, schedules and objectives recommended by the Task Force on measures to increase wood waste reutilization.

4. The strategy and action plan should cover at least the 1990 - 2000 period. The strategy and action plan should have the goals of both maintaining current levels of wood waste reutilization and reutilizing at least 25 and 50 percent of remaining wood waste being discarded by 1992 and 2000 respectively.

5. The wood waste data base that has been initiated with this report should be regularly updated and refined by the Ministry of the Environment.

6. Given the evidence of potential uses for wood waste, the Ministry of the Environment should consider measures to ensure that only wood wastes that are contaminated in such a way as to prevent reutilization should enter disposal facilities. These measures should include consideration of mechanisms to require wood waste reutilization if wood waste generators do not make significant progress in increased reutilization of wood waste materials. All players in wood related industries must be made aware that, given

the current state of the environment, wood waste should be used to its highest potential.

7. Opportunities should be pursued to divert wood waste from disposal to productive reuse. For example, agricultural lands in Ontario are severely depleted of organics, so making compost from wood waste for which there is a poor market should be encouraged. The wood waste problem would be addressed while improving the condition of agricultural lands. Another example, the use of sawdust as bedding for animals represents an environmentally efficient use of a resource. The sawdust is reused as bedding and is then returned to the soil where the nutrients are recovered.

8. The Ministry of the Environment, together with the Ministry of Energy, should encourage and foster co-operative arrangements between wood waste producers, and haulers/users requiring or potentially requiring the wood waste.

Management Recommendations For Specific Wood Wastes

The following recommendations are intended to encourage the minimization of wood waste generation and guide wood waste reutilization. While they should be considered preliminary and subject to refinement through fulfillment of Recommendations 2, 3 and 4, they represent actions that can be taken immediately and over time to directly minimize wood waste requiring disposal.

9. The Ministry of the Environment should consider financial and other measures to discourage non-reusable pallets.

10. The Ministry of the Environment should encourage the use of chippers and other wood processing technology by generators, haulers and receivers of broken pallets and pallet pieces in order to maximize opportunities for recycling these wood wastes.

11. The Ministry of the Environment should facilitate and support the use of fire logs manufactured from wood waste for use in home fireplaces, subject to other environmental considerations such as impact on air quality.

12. The Ministry of the Environment should work with the waste management service and demolition industries to establish a network of facilities across the province to process and market wood waste.

13. Consistent with using wood waste to its highest potential (Recommendation 6), the Ministry of Energy should continue to support the recovery of energy from wood wastes, and provide focussed support for wood waste initiatives in metropolitan areas where construction/demolition wastes and manufacturing wood waste residues pose significant disposal problems. Support initiatives should emphasize energy recovery where wood waste reuse and recycling are demonstrated to be unrealistic. Appropriate support includes provision of technical data on wood waste energy recovery equipment, and capital cost financing of energy from wood waste facilities.

1.0 INTRODUCTION

The management of solid waste has become a major environmental issue in Ontario. Existing waste disposal capacity is severely restricted in many areas, and new disposal capacity is costly and time-consuming to acquire. There is renewed emphasis on waste diversion initiatives and the inclusion of these approaches within the sustainable development concepts that are increasingly included in economic development planning.

In order to maximize the waste diversion initiatives, it is first necessary to develop a data-base that profiles existing waste management practices and permits identification of waste reduction opportunities. Once this information base has been compiled, it becomes possible for the public and private sectors to develop waste reduction initiatives to reduce waste generation and maximize the utilization of the wastes that are generated.

This report documents current wood waste generation and management in Ontario with a focus on southern Ontario. Major generators of wood wastes are identified, together with the types and quantities of wood waste generated. Current wood waste management practices are described and the costs associated with wood waste management are profiled. This information has been compiled through an inventory of wood waste generators, and other available data. In addition, five case-studies are presented to illustrate the potential for wood waste reduction initiatives.

Section 2 of this report describes how the wood waste inventory was conducted. Wood waste generation data are presented in Section 3 and wood waste management data are presented in Section 4. Case studies are presented in Section 5 and in Section 6 recommendations are made on how wood waste management can be improved with particular regard to increased wood waste reutilization.

2.0 INVENTORY DESIGN AND IMPLEMENTATION

This section describes the methodology and research associated with developing the southern Ontario wood waste inventory.

2.1 Definition and Objectives

"Wood waste" has been defined to mean all wood, wood fibre and bark that is discarded, unused or unwanted by a manufacturing, construction or demolition operation, municipality, government agency or other organization.

The objectives of this study have been to identify and illustrate wood waste generation and management practices in Ontario. Specifically the following have been identified:

- the major wood waste generators in southern Ontario;
- the type of wood waste generated by each generator;
- the quantities of wood waste generated by each generator;
- the current wood waste management practices of each generator;
- the costs associated with the management of wood wastes; and
- wood wastes generated in northern Ontario.

2.2 Methodological Considerations

The methodology required to accomplish the objectives had to take into account several concerns:

- the geographic extent of the study area;
- the general lack of documented wood waste information available; and
- differing levels of awareness among generators regarding their wood wastes.

The geographic extent of the study area was defined for southern Ontario to include the Algonquin, Southeastern, Southwestern and Central administrative districts of the Ontario Ministry of Natural Resources. Essentially, this includes all parts of Ontario south of the French and Mattawa Rivers. Northern Ontario is defined to include all others parts of Ontario.

Different methodologies were used to gather wood waste generation and management data from southern Ontario and northern Ontario. In southern Ontario, an inventory survey of wood waste generation and management was undertaken among significant wood waste generators; the survey was supplemented by additional documented wood waste generation and management data. Sections 2.3 - 2.7 describes how the inventory survey was developed and conducted.

Data on wood waste generation and management in northern Ontario has been developed from Ministry of Natural Resources primary wood industry data, and by pro-rating data from southern Ontario for other sectors generating wood waste.

The general lack of documented wood waste information available has required assumptions to be made in designing the methodology in order to permit flexibility in the application of the methodology. This was an important factor in defining the range of wood waste generators to be captured through survey and the development of a survey questionnaire.

It was anticipated at the outset that there would be differing levels of awareness among generators regarding the amount, type, handling and disposal of their wood wastes. This has been an important factor in standardizing data to provide a common basis for analysis (e.g. annual tonnages) even though some generators were able to provide specific data on some other basis (e.g. weekly number of pallets).

2.3 Selection of Wood Waste Generators

The methodology for identifying potentially significant southern Ontario wood waste generators of interest to this study was based on a categorization and screening approach to identify first, the types (categories) of company/organization that may be significant wood waste generators and second, which specific companies/organizations within each relevant category could potentially be a significant wood waste generator.

Using this methodology, the following categories and screening criteria have been used to identify a list of potentially significant southern Ontario wood waste generators.

2.3.1 Manufacturing industry:

Sawmills and related mills (SIC Group 24) with 10 employees or more. Companies in this SIC Group were anticipated to have the highest wood waste generation rates on a per employee basis because they convert raw wood into a usable wood product;

Secondary forest products industries (SIC Group 25) with 40 employees or more. Companies in this SIC Group were also anticipated to have high wood waste generation rates on a per-employee basis. However, because these companies use wood that has been processed by sawmills, wood waste generation was anticipated to be lower than in companies in SIC Group 24.

Other manufacturing industry (all other SIC Groups) with more than 500 employees. Although these companies do not generate wood waste directly from their manufacturing activities, they

were anticipated to generate potentially significant quantities of wood waste in the form of pallets, skids and other wood packaging.

Scotts Directory of Manufacturing Companies (1988) was used to select all southern Ontario companies meeting the criteria for inclusion in the inventory. In addition, the Canadian Wood Pallet and Container Association provided a list of its members to assist in identifying potentially significant wood waste generating companies in the study area. The Ontario Waste Exchange provided a listing of companies that generate wood waste.

2.3.2 Municipalities

All municipalities in southern Ontario with a population of at least 5,000 people were included. Municipalities can be significant wood waste generators as a result of parks maintenance, public works, public utility commission and other activities. A listing of all municipalities meeting the criteria for inclusion in the study was obtained from the Ministry of Municipal Affairs.

2.3.3 National/Provincial Parks and Conservation Areas

All national/provincial parks in southern Ontario were included in view of the potential for possibly significant wood waste generation as a result of maintenance activities in these areas. Listings were prepared from information provided by the Ontario Ministry of Natural Resources and Environment Canada of all National/Provincial Parks and Conservation Areas in the study area.

2.3.4 Waste Management Companies

All members of the Ontario Waste Management Association were included. The waste management companies belonging to OWMA account for approximately 80 percent of the value of industrial/ commercial waste management contract activity in Ontario. The OWMA provided a listing of its members for use in this study.

2.3.5 Demolition Companies

Three demolition companies were included in the study. These companies represent the largest companies in the demolition industry and account for an estimated minimum of 58 percent of demolition activity (and therefore related wood waste) in southern Ontario. Available data suggest the information obtained from these companies is indicative of wood waste generation generally in the demolition industry.

2.4 Questionnaire Development and Research Methods

Questionnaire surveys and data sheets were developed to obtain southern Ontario wood waste data and information from all companies/organizations identified as potentially significant wood waste generators. A sample questionnaire and data gathering sheet are provided in Appendix A.

The questionnaire requested wood waste generators to provide both quantitative and qualitative information on the wood wastes they generate. Quantitative Information requested included the company name/organization and contact name and phone numbers. The types of waste generated were requested, together with the quantities of each waste type. Where wood waste generation varied as a result of seasonal or other factors, average and maximum wood waste generation rates were requested. Current wood waste management practices and the costs associated with these practices were also requested.

Qualitative information requested focussed on the respondent's perception of change in wood waste generation and management. Companies/organizations were asked to identify future trends in either their activities or the local waste management situation that may affect wood waste generation or management. Information was requested about alternative approaches that companies or organizations were aware of regarding the management of their wood wastes, and why these approaches have not been adopted by the company or organization. Finally, other observations were requested concerning the generation and management of wood waste.

The survey questionnaire was administered in two ways. Mail-out questionnaires to industry have frequently attracted only a poor response. Therefore, a telephone survey was used to contact all identified private sector wood waste generators. All private sector organizations were grouped geographically. Following a training session, staff in MacLaren offices in Windsor, London, Waterloo, Toronto and Ottawa administered the survey questionnaire to the private sector organizations in their area. Information was entered directly onto the data sheets as it was collected. Call-back messages were left and a maximum of two follow-up phone calls were made in the event that the appropriate contact person was not immediately available.

The questionnaire survey and data collection sheet were mailed-out to all identified public sector wood waste generators. These generators were asked to enter requested data by the survey directly onto the data collection sheets and to return these using the stamped, self-addressed envelope provided. A follow-up phone call was made to all public sector contacts who had not returned data sheets one month after the survey questionnaire were mailed out.

During the survey period, additional sources of data became available. In some cases, these data related only to wood waste generated by one or a few companies; in other cases it related to broader wood waste survey work that had been conducted with respect to wood waste generation within municipalities or industry sectors. This information was reviewed and has been incorporated into the data on wood waste generation and management, as appropriate.

2.5 Data Quality and Manipulation

2.5.1 Data Quality

During the course of the study a number of uncertainties with regard to knowledge and ability of generators to accurately provide data were uncovered and are described below:

- few organizations have quantified wood waste generation or have taken more than ad-hoc initiatives to reduce, reuse, recycle or

recover wood wastes;

- manufacturers of non-wood products consider wood wastes as part of a mixed waste stream. While they may be able to estimate overall waste generation, the proportion that is wood waste is at best a "guesstimate";

- industrial/commercial generators of wood waste relate waste generation to the number of dumpster or other bins at their facility and to the number of pick-ups per week or month that their service contract calls for, rather than direct knowledge of their waste quantities;

- wood waste quantity data reported by most generators is based on assumptions rather than on direct measurement. These assumptions reflect a visual measurement of wood waste as a percentage of total waste, estimates of cubic yards of wood waste also based on visual estimates, or estimated proportion of production.

- most companies cannot identify their current overall waste management costs, particularly the cost of wood waste management; and

- waste management information in large organizations is often scattered among many different departments and individuals. This prevented some generators from responding to the survey and limited the response of others. In some cases, all waste management information was considered confidential.

2.5.2 Data Manipulation

Standardization of data received has been necessary in order to provide a common basis for analysis. Time units, wood waste quantities and moisture content of wood waste have all been standardized.

Time Units

All wood waste quantity data has been standardized to a monthly basis.
The standardization of time units has been done by scaling up or down the time units reported by waste generators (i.e. annual data were divided by 12, weekly data were multiplied by 4).

Waste Quantities

All waste quantity data is expressed in tonnes. Waste quantities reported in volume units have been converted into tonnes using the following conversion factors:

- 3.0 cubic yards of sawdust weigh 3.5 tonnes;
- 4.0 cubic yards of end cuts and other assorted wood pieces weigh 6.5 tonnes;
- 40 pallets or skids weigh 1 tonne;
- 1.3 cubic yards of bark weigh .377 tonnes; and
- 40 cubic yards of brush weigh 1 tonne.

Moisture Content

All wood waste quantities are expressed in bone dry tonnes, which represents the weight of

wood fibre at 0 percent moisture. The standardization of wood tonnages into bone-dry tonnes has been conducted according to the following conversion factors:

- green wood, e.g. fresh cut timber and sawmill wastes, contains 50% moisture;
- air dry wood, e.g. pallets and skids, contains 20% moisture; and
- oven dry wood, e.g. wood waste from secondary wood products industries (such as furniture and window manufacturers), contains 12% moisture.

2.6 Data Entry

Inventory data has been entered onto FOXBASE, which is fully compatible with dBASE III PLUS. Data entered onto the data base include:

- name of company/organization and city/county/region of location;
- contact name and phone number;
- SIC Group (manufacturing industry only);
- type of wood waste generated;
- quantity of wood waste generated expressed as the tonnage generated per month;
- the bone-dry tonnage equivalent generation; and

- existing wood waste management practices, including wood waste reduction and reutilization practices.

Other information requested on the survey questionnaire is not suitable for entry onto the database, but is used to assist in the interpretation of the data obtained. The data base is available on disk.

2.7 Inventory Response

Table 2-1 summarizes responses of the inventory survey.The overall response rate is considered satisfactory for a survey of the kind undertaken although it is evident that further research will provide better definition of wood waste generation patterns in the future.

Table 2-1

Summary of Inventory Survey Questionnaire Response

Type of Organization	Number Contacted	Number Providing Information	% Responding
All Manufacturers	680	387	57
Municipalities[1]	265	96	36
Provincial/National Parks	68	32	47
Conservation Authorities	38	30	79
Waste Management Companies	88	48	55
Total	1184	638	54

3.0 WOOD WASTE GENERATION

3.1 Wood Waste Generation: Southern Ontario

This section presents estimates of wood waste generation by sector in Ontario. Inventory data are summarized for:

- 387 manufacturing companies;
- 96 municipalities. These data represent the amount of wood waste generated by the municipalities themselves as a result of their own activities;
- 3 demolition companies accounting for estimated 58 percent of demolition activity in Ontario;
- 32 provincial and national parks; and
- 30 conservation areas.

Table 3.1 presents the total amounts of wood waste estimated to be generated in southern Ontario by these sectors on the basis of extrapolating inventory results to include all organizations estimated to exist in each sector. Detailed inventory data for each sector is provided in Appendix B.

Two southern Ontario sectors that generate wood waste have not been included in the inventory: primary forest products including, residential construction and commercial landscaping. Other sources of information have been used to estimate wood waste generated by these activities, and these are identified in Table 3.1

TABLE 3–1

ESTIMATED TOTAL WOOD WASTE GENERATION
IN SOUTHERN ONTARIO
(1988)

SECTOR	TONNAGE REPRESENTED BY SAMPLE SIZE (BD TONNES)	ESTIMATED TOTAL WOOD WASTE GENERATION (BD TONNES)
SECONDARY WOOD INDUSTRY/ GENERAL MANUFACTURING (1)	204,500	463,900
WOOD CONTAINER INDUSTRY (2)	600,000	600,000
MUNICIPALITIES (1)	31,760	158,800
CONSERVATION AREAS/ PROVINCIAL PARKS (1)	520	900
PRIMARY WOOD INDUSTRY (3)	461,400	461,400
DEMOLITION (1)	214,360	369,600
RESIDENTIAL CONSTRUCTION (4)	70,900	70,900
COMMERCIAL LANDSCAPING (5)	7,400	22,000
TOTAL	1,590,840	2,147,500

NOTES:
1. Estimated on basis of inventory data
2. Canadian Wood Pallet and Container Association estimate
3. Ontario Forestry Industry Statistics, 1986
4. Assumes 1.5 BD tonnes of wood waste per new house
5. Extrapolation from Toronto Wood Waste Survey, Ministry of Energy, 1984

Finally, companies in the primary wood and wood container industries have been included in the inventory, and data from those companies responding to the inventory are discussed below and detailed in Appendix B. For the primary wood industry as a whole, however, wood waste generation and management data has been based on MNR data. For the wood container industry as a whole, wood waste generation and management data have been estimated based on an Ontario survey conducted by the Canadian Wood Pallet and Container Association. This survey achieved a higher response rate than the inventory described in this report.

3.1.1 Wood Waste Generation By Sector

3.1.1.1 Manufacturing Companies

The wood waste inventory includes wood wastes that are generated by facilities in the manufacturing sector. Responses were received from 387 companies, of whom 299 provided quantitative information.

Primary Wood and Wood Container Industries The primary wood and wood container (e.g. pallet) industries are comprised of manufacturing companies that process green wood. The moisture content of green wood varies according to tree species; the industry standard assumes that green wood has a 50 percent moisture content.

The Ministry of Natural Resources (MNR) maintains a data base on primary wood industry production and waste generation. In 1986, the most recent year for which detailed data are available, MNR estimates that 461,400 BD tonnes of wood waste were generated by the primary forest products industry in southern Ontario.

The definition of wood waste applied by the MNR to this industry differs from the definition used for this study. The MNR definition excludes residuals from the primary wood industry that ultimately find application of some kind. The quantification and application of these residuals is addressed in Section 4.

The number of primary wood and wood container companies that responded to the wood waste inventory survey totaled 170. The type of wood wastes generated are sawdust, shavings, bark, end cuts/chips, and hogfuel. The Canadian Wood Pallet and Container Association has completed a survey which identifies that an estimated 600,000 BD tonnes of wood waste are generated by the wood container industry. Companies responding to the inventory described in this report generate an estimated average of 1896 BD tonnes per year.

3.1.1.2 Secondary Wood Industry and General Manufacturing Companies

The secondary wood industry is comprised of those companies that primarily utilize oven (kiln) dried wood. The moisture content of oven-dried wood varies, but has been assumed to be 12 percent for this study.

General manufacturing companies include companies that do not utilize wood as a primary material in their production process, but which generate wood waste from the packaging of the raw materials or components they utilize and the products they produce. The types of wood waste generated by these companies are typically pallets and skids. The moisture content of these wood wastes varies, but has been assumed to be 20 percent.

A total of 178 secondary wood and general manufacturing companies responded to the wood waste inventory survey. Additional information on wood waste generation by companies in these sectors was obtained from waste management haulers and pallet recyclers. The annual estimated wood waste generation of all secondary wood industry and general manufacturing companies in southern Ontario is estimated to be 463,900 BD tonnes. Wood waste generation is concentrated in assembly industries (e.g. automotive and aircraft) where wooden pallet waste generation is the principal wood waste.

3.1.1.3 Municipalities

Fifty-two municipalities responded to the inventory survey with quantitative information. Another 44 responded with non-quantitative information. The types of wood waste generated by municipalities include tree branches and brush from trimming operations, damaged guard rails and hydro poles, pallets/skids, construction materials, and miscellaneous items (e.g. Christmas trees).

The total amount of wood waste generated by the responding municipalities providing quantitative wood waste data is estimated to be 31,760 BD tonnes per year. This represents an estimated 20 percent of wood waste generated by municipalities in southern Ontario; these municipalities are therefore estimated to generate 158,800 BD tonnes of wood waste per year.

3.1.1.4 Conservation Authorities and Provincial/National Parks

Wood waste inventory data was received from 30 Conservation Authorities and 32 Parks, representing 58 percent of the Conservation Areas and Parks in southern Ontario. The type of wood waste reported included tree limbs and brush, stumps and lumber.

This wood waste is generated by conservation area and park maintenance activity. The overall quantity of wood waste generated by Conservation Authorities and Parks responding to the inventory survey is estimated to be 520 BD tonnes per year. It is therefore estimated that 900 BD tonnes of wood waste is generated by all Conservation Authorities and Parks in southern Ontario.

3.1.1.5 Construction/Demolition Wood Wastes

Construction Wood Wastes. Wood waste generated in the residential construction sector is estimated based on research conducted in the Region of Peel in 1988. This research identified that the construction of 126 townhouses averaging 1500 square feet in Mississauga generated an average of 1.1 tonnes of wood waste per townhouse unit. The Canada

Mortgage and Housing Corp. (CMHC) estimates that the average size of a new single family home in Ontario is 2060 square feet. Therefore approximately 1.5 tonnes of wood waste is generated in the construction of an "average" home in Ontario. This estimated wood waste generation rate has been multiplied by the 1988 housing starts, as provided by CMHC, to calculate the wood waste generated by residential housing construction in Ontario.

As indicated in Table 3.1, an estimated 70,900 bone dry (BD) tonnes of wood waste was generated by the southern Ontario residential construction industry in 1988. This figure does not include wood wastes generated in the construction of apartments and condominiums, for which data is unavailable.

Residential housing wood waste is comprised of damaged framing, lumber, end cuts, plywood, particleboard and molding. Wood wastes are also generated by other types of construction activities. Discussion with industry representatives has identified that construction activity associated with concrete is a significant source of wood waste. Wood is commonly used to form concrete, although plastic forms are increasingly used by the industry. Wood forms are reused until they become damaged at which time they are discarded.

Demolition Wood Wastes. The demolition industry, like the construction industry, is dominated by a small number of large firms that account for a disproportionate amount of business activity within the industry. At the same time, however, there are a large number of small companies who are competitive in the market for medium and small sized demolition contracts. The fragmentation of the industry, and the lack of an association that broadly represents the industry, makes it extremely difficult to identify the range of demolition contractors to be included in an inventory on waste generation.

The three largest demolition contractors in southern Ontario are Greenspoon Brothers, Teperman and Tiger Wrecking. By their own estimation, these companies account for between half and two-thirds of annual demolition business in southern Ontario. As indicated in Appendix B, Greenspoon generates approximately 6,600 bone dry tonnes of wood waste per month (79,000 BD tonnes per year) and Tiger Wrecking generate approximately 5,280 bone dry

tonnes per month (63,360 BD tonnes per year). Teperman was unable to provide an estimate of wood waste generation, but likely generates approximately 6,000 bone dry tonnes per month (72,000 BD tonnes per year) based on discussion with the industry. Wood waste generated through demolition activities in southern Ontario is estimated to be 369,600 BD tonnes.

Wood waste generated by the industry reflects wood used in the construction of the structures that are demolished. Wood is generally highly contaminated by other wastes.

3.1.1.6 Commercial Landscaping

Wood wastes generated by the commercial landscaping industry have been estimated based on the Toronto Wood Waste Survey, conducted in 1984. This survey indicates that 7,400 BD tonnes of wood waste was generated in the greater Toronto area at that time; extrapolation of this amount to southern Ontario indicates that 22,000 BD tonnes of wood waste from this sector is generated annually. Brush and tree limbs are principle wood wastes generated by this sector. Wood waste generation by this sector is likely to have grown since the mid-1980's as population has grown. However, wood waste generated by this sector only contributes in the order of 1 percent to southern Ontario wood waste generation.

3.1.1.7 Total Wood Waste Generation In Southern Ontario

Total wood waste generation in southern Ontario by the sectors discussed above is estimated to be 2,147,500 BD tonnes in 1988.

3.2 Wood Waste Generation In Northern Ontario

Wood waste generation in northern Ontario was beyond the scope of the wood waste inventory, as discussed in Section 2. Estimates of wood waste generation in northern Ontario have therefore been developed from existing MNR data and from extrapolation of southern Ontario wood waste generation data to northern Ontario.

Data on wood waste generation by the northern Ontario forest products industry are maintained by MNR. Wood waste generation by each MNR region in northern Ontario is detailed in Appendix C. In total, an estimated 749,000 BD tonnes of wood waste were generated by the industry in northern Ontario in 1986, the most recent year for which data are available.

Wood waste generation in northern Ontario by sectors other than the primary forest products industry has been extrapolated from southern Ontario wood waste generation data on the basis of the population of northern Ontario relative to southern Ontario. This approach approximates wood waste generation in northern Ontario by sectors other than the primary forest products sector, although it does not take into account differences in the economy and industry in northern Ontario relative to southern Ontario.

It is therefore estimated that approximately 96,000 tonnes of wood waste were generated in northern Ontario by sectors other than the primary forest products industry.

Total wood waste generation in northern Ontario is estimated to be 845,000 BD tonnes per year.

3.3 Total Wood Waste Generation In Ontario

Based on the data presented in Sections 3.1 and 3.2, an estimated 2,992 million BD tonnes of wood waste are generated annually in Ontario. This should be considered a conservative estimate because:

1) the inventory on which several of the data in Table 3.1 are based was not designed to capture small wood waste generators; and,

2) the quantities of wood waste from some sources is unknown and cannot be estimated. These sources include, for example, but are

not necessarily restricted to, land-clearing activities by the agricultural community, and domestic landscaping activity.

3.4 Future Trends In Wood Waste Generation

Most wood waste generators reported that they do not anticipate significant changes in wood waste generation.

The impetus for changed wood waste management practices is external to the wood waste generators themselves, and is focussed in a range of stakeholders that have identified opportunities for wood waste reutilization. It is clear that significant potential exists for increased wood waste 3Rs activity and this is discussed further in Section 4.

4.0 OPTIONS FOR WOOD WASTE MANAGEMENT

4.1 Wood Waste Management

Wood currently classified as "waste" and disposed of at landfills or other facilities where no future use is intended may have potential value or use in the marketplace. It is not coincidental that resource depletion and "waste" disposal problems have arisen simultaneously.

The most environmentally sensitive wood waste solutions are those that return the discarded wood to the beginning of the resource cycle, replacing the extraction of virgin wood with processing of wood waste in preparation for use. Therefore, wood waste utilization practices that maximize recovery of the resource value of wood, such as manufacturing processes which would normally use virgin wood, or directly returning the nutrient-rich organics back to the ecosystem represent preferred uses of the resource. Other uses which recover some of the resource value are recommended as well, but the uses which regain the most resource value are environmentally preferred.

Reduction, reuse, recycling and recovery represent in descending order of preference the preferred options for wood waste management. Disposal of wood waste in approved facilities may also be necessary. Each of these terms are defined as follows:

> Reduction is the elimination of the production of waste to some degree. Reduction in wood waste can be achieved through improved production technology, a change in product design or some other method. For example, saw blade and milling technology in the sawmill industry can reduce wood waste.
>
> Reuse refers to the act of using a product more than once, preferably a repeated number of times, as opposed to discarding it after only one use. The use of reusable pallets by the grocery products industry is an example of reuse and can be contrasted with the widespread use of one-way, "disposable" pallets

by other industry sectors.

Recycling may be defined as the use of a waste material such that it can be remade into another product. The use of wood chips from a pallet in particle board production is an example of recycling.

Recovery refers to the use of a waste material, usually for heat recovery, such that it captures some of the value of the resource. The use of bark or endcuts for fuel is an example of energy recovery. The composting of sawdust is a material recovery option.

Disposal refers to the discard of waste may have been reused before final disproval. This is the least desired management option, but is necessary where other management approaches are not undertaken or are inappropriate.

4.2 Wood Waste Markets and Applications

Table 4-1 summarizes current wood waste applications. Overviews of these are provided in the following sections.

Extensive wood waste utilization is already occurring and estimates of these activities by application are provided in Table 4-2. If the implementation of these applications is to be maximized, greater organization of potential wood waste suppliers and potential wood waste markets will be required.

4.2.1 Pulp and Paper

Pulp and paper mills use wood chips in their production processes. Although they consume high proportions of virgin wood chips, they also use wood chips that are produced as a result of primary wood processing i.e. sawmill operations. The pulp and paper mills only accept clean, uncontaminated chips, but for many wood waste generating industries the production

Table 4-1

Summary of Existing Wood Waste Reutilization Opportunities

Wood Waste Type	Reutilization Opportunity	Type Of Reutilization
Sawdust/Shavings, Hog Wood	Particle Board	Recycling
	Bedding for Livestock	Reuse
	Compost (including use as a bulking agent in composting municipal sewage)	Recovery
	Fire Logs	Recycling
	Domestic Pet Litter	Reuse
	Energy Recovery	Recovery
Chips	Pulp & Paper Mills	Reuse
	Landscaping	Reuse
	Recreational Applications (e.g. trails, ski hills, golf courses)	Reuse
	Fire Logs	Recycling
	Energy Recovery	Recovery
Bark	Landscaping	Reuse
	Compost	Recovery
	Recreational Applications	Reuse
	Energy Recovery	Recovery
Pallets	Recycle into refurbished pallets	Recycling/ Reuse
	Energy Recovery	Recovery

Note: Other wood waste types such as end cuts, moulding, construction and demolition waste also have potential for reutilization but require processing into sawdust, chips, hogfuel or shavings prior to application.

Table 4-2

Estimated Consumption of Wood Waste in Southern Ontario - 1988

Wood Waste Applications	Preliminary Estimates Of Wood Waste Reutilized (bone dry tonnes)
Pulp and Paper (1)	10,000
Chip and Particle Board (2)	200,000
Livestock Bedding (3)	253,000
Compost/Mulch (4)	25,000
Fire Logs (5)	36,000
Recreational (3)	25,000
Energy Recovery (on-site and off-site) (6)	300,000
Landscaping, Pet Litter and Miscellaneous (4)	64,000
Total:	912,000

Sources:

1. Canadian Pulp and Paper Association Statistical Reports
2. Interviews, Ontario Forest Industry Statistical Reports for 1986
3. Inventory data
4. Inventory data, interviews
5. Estimate provided by Ministry of the Environment
6. Inventory data, Ontario Forest Industry Statistical Reports, interviews

of wood chips acceptable to the pulp and paper industry could be easily undertaken through the operation of a wood chipper.

Broken pallet pieces, end-cuts from furniture manufacturing and sawmill off-cuts are wood wastes which can be sold to pulp mills once they have been chipped; and in the case of pallets, nails can be removed with a magnetic separator. Co-operation and organization among wood waste generators could result in cost effective chipping operation, and marketing. The effectiveness of this approach has been demonstrated by Fibreco in British Columbia. Fibreco is a joint venture by 53 sawmills in the province to market waste wood chips generated by the mills. The company has developed B.C. markets for chips and has also become the largest wood chip exporter in the world.

4.2.2 Chip and Particle Board

The use of waste wood chips, sawdust and shavings in the manufacture of chipboard, particle board and related products makes effective use of the resource. This is a common practice for sawmill wood waste generators, and could be extended to other wood waste generators, particularly if intermediate processing of wood pieces (e.g. end cuts) into suitable feedstock (e.g. chips, shavings) was undertaken. Board products can be marketed for a wide range of applications and the use of wood wastes in the manufacturing process reduces both the demand on virgin wood and the need for waste disposal.

4.2.3 Bedding for Livestock

Some farmers who own livestock have been buying sawdust to use as bedding for their animals. It is estimated that this market could be expanded significantly before reaching its potential. The marketing of sawdust to farmers is an informal process at present, but informality is not a barrier to the expansion of the market. Not only does the sawdust serve a primary purpose in this use, but its subsequent use on fields (mixed with the manure) helps to build up organics in degraded soil and maintain soil quality. This type of resource use is "closed-loop", so it represents sustainable use rather than "linear" use of wood resources

(the situation when wood wastes are disposed of without material or energy recovery).

4.2.4 Composting

Composting of wood waste represents environmentally sensitive wood waste usage. The nutrient and organic value housed in the wood waste is recovered and returned to the natural environment for use in agriculture, recreation, filling etc. A wide range of uncontaminated wood wastes can be suitable for composting. Bark appears to be the wood waste in the largest over-supply, so composting opportunities are particularly significant in addressing bark waste management.

Depending on the market cited for the compost, it may or may not generate revenue. For this reason composting is most likely to develop initially in sectors or regions that face high wood waste disposal costs.

4.2.5 Energy Recovery (Heat Value)

Energy recovery from wood wastes may reduce or avoid fuel costs, thereby increasing the competitiveness of industry.

Small scale recovery of wood wastes for energy generation takes place routinely in Ontario. Many companies use wood wastes on-site to supplement boiler fuel. In addition, many companies allow employees to take wood wastes for use in home fire-places.

Large scale recovery of wood wastes for their energy value also takes place. This option is particularly attractive where large supplies of wood waste are readily available in areas of high energy cost. Some preliminary processing may be necessary (e.g. chipping or hogging) to prepare wood wastes as a suitable feedstock for energy recovery. Large scale projects to recover energy from wood wastes have been implemented in northern Ontario.

4.2.6 Fire Logs

Firelogs for use in domestic fireplaces can be fuelled by the burning of fire logs produced from extruded wood waste chips and sawdust, rather than virgin wood. In urban environments, where virgin wood is scarce, the use of manufactured fire logs maybe a reasonable alternative.

4.2.7 Recreational Applications

Recreational uses for waste wood chips and bark abound. Chips and bark may be used on walking trails in parks by all levels of government. Because parks are located throughout Ontario in settings ranging from intense urban to almost completely natural, wood waste generators are likely to be in close proximity to a park (or playground) which could use the chips and bark on their trails.

Park uses for wood waste extend beyond their trails to their gardens. Wood waste makes a high quality mulch, popular for landscaping.

Private recreational facilities can also make use of wood waste. Mulch can be used on ski slopes for erosion control and to mould the hill into the desired contours and moguls. Mount McKay in Thunder Bay, for example, has used the waste produced at the local Abitibi Mill for just such purposes.

The revenue associated with these recreation-related markets is likely to be lower than if wood wastes were sold for manufacturing purposes since no end product is being produced by the recreational-related markets. However, 3Rs objectives would be met and costs associated with disposal would be avoided.

4.2.8 Landscaping

Landscaping is a use for waste chips and bark that is broader than the recreational applications described above. Landscaping businesses, homeowners, garden centres and

corporations are all likely to make excellent use of these wastes in their landscaping and gardening if the wastes are made available to them.

4.2.9 Domestic Pet Litter

Wood shavings are required by owners of pets such as rabbits, gerbils and guinea pigs. Although this represents one of the smaller potential markets, the use of wood wastes rather than virgin wood is preferred.

4.3 Current Wood Waste Management Practices

4.3.1 General

There are three principle items that contribute to wood waste disposal costs: the container in which wastes are stored, the pick-up and haulage of wastes to the disposal site, and the disposal site tipping fee. Waste management companies service an account where the generator pays for rental of refuse containers, haulage to disposal and tipping fees. The frequency of pick-up is a function of the volume of refuse generated. The cost and therefore the sensitivity of generators is related to total cost and impact on profitability of the firm.

Wood waste generators are generally unable to identify the costs associated with the disposal of their wood wastes. Some companies were able to report the tipping fee at the local landfill. However, few know the full costs of wood waste disposal. It may be concluded that the lack of awareness and therefore sensitivity to waste management costs as a stimulus to implement waste reduction initiatives is not apparent at present cost levels.

Tipping fees in southern Ontario are based on the weight of material received for disposal. Tipping fees at the time of the inventory ranged up to $85/tonne in the Metro Toronto area, but continue to be substantially lower in most other parts of the province. In rural areas of the province, tipping fees are often based on the size of truck disposing of waste at the site; in many areas, there are no tipping fees at the disposal site.

4.3.2 Waste Management Companies

The 88 solid waste management companies belonging to the Ontario Waste Management Association that operate in Southern Ontario were contacted to determine the quantities of wood waste that they handle. In total 48 companies responded to the inventory survey; 17 of these companies supplied quantitative data indicating that they each haul an average of 2,700 BD tonnes per year. Companies that did not supply quantitative data considered estimates of waste quantities they handle to be proprietary information.

The 3Rs potential of wood wastes have been recognized by several waste management companies including Harkow, Steetley, Philip Enterprises, and All-Waste Removal. Each of these companies and, probably, others have reviewed and implemented wood waste 3Rs activities. Philip Enterprises is now composting wood wastes, and All-Waste Removal has established a subsidiary to process wood waste as a feed for energy recovery facilities and for inclusion in particle board manufacture.

4.3.3 Wood Waste Management In Southern Ontario

Current wood waste management practices in southern Ontario are summarized in Table 4-3 according to wood waste generation activity. These practices are described by sector for southern Ontario and, at the end of this section, for northern Ontario.

4.3.3.1 Primary Forest Industry

Wood waste management practices generally followed by companies in this sector include land disposal, sale or donation to farmers as animal bedding, and sale to other manufacturers as raw material.

There is significant demand for many wood wastes from this. In particular, wood chips are frequently sold to the pulp and paper industry, and sawdust and shavings are used as bedding material. The actual level of reutilization of these materials is highly dependent on distance

Table 4-3

Estimated Wood Waste Management Practices in Southern Ontario By Sector - 1988
(bone dry tonnes; percent in brackets)

Sector	Recycled /Reused/Recovered	Disposed Of	Total
Primary Forest Industries (1)	277,000 (60)	184,400 (40)	461,400 (100)
Demolition (2)	0 (0)	369,600 (100)	369,600 (100)
Residential Construction (2)	5,000 (7)	65,900 (93)	70,900 (100)
Conservation Authorities/Parks (2)	850 (94)	50 (6)	900 (100)
Municipalities (2)	31,800 (20)	127,000 (80)	158,800 (100)
Secondary Wood Products and General Manufacturing (2)	227,200 (46)	266,700 (54)	463,900 (100)
Wood Container Industry (3)	360,000 (60)	240,000 (40)	600,000 (100)
Commercial Landscaping (4)	10,000 (47)	12,000 (53)	22,000 (100)
TOTAL	911,850 (42)	1,265,650 (59)	2,147,500 (100)

Sources:

1. Ontario Forest Industry Statistics, 1986 data
2. Inventory data extrapolation
3. Canadian Wood Pallet and Container Association
4. Extrapolation Toroto Wood Waste Survey, Ministry of Energy, 1984.

from market since many points of generation are remote from energy plants or agricultural areas.

Bark is the most commonly non-utilized wood waste generated by this sector. The proportion of non-utilized wood waste reported for 1986 (see Table 4-3) corresponds closely to the 41% figure recorded by MNR for 1984. An estimated 184,000 BD tonnes of wood waste from the primary forest industry sector in southern Ontario is estimated to have been landfilled in 1986.

4.3.3.2 Demolition

Historically, the demolition industry has practiced high levels of materials separation for the purpose of salvaging both reusable items that could be sold, and other materials that could be recycled. Today, significant mechanization in the industry make widespread materials separation impractical. In addition, high labour costs are reinforcing the trend towards increased mechanization. Each of the companies contacted identified these trends as key barriers to increased materials recovery within the industry.

Another obstacle to wood waste recovery is the cost of demolition work to a development project. Industry representatives estimate demolition contracts at, typically, 1 or 2 percent of the total cost of a development. The industry reports that the key to winning contracts is the speed with which the demolition can be completed and, only secondarily, the cost of the demolition work. This situation arises because of the relative cost of demolition to potential value/revenue from development of property.

This point is particularly relevant with respect to landfill tipping fees. In spite of the large quantities of material disposed of by the demolition industry, high tipping fees (even at $100/tonne in the Metro Toronto area) are a poor incentive to waste reduction activity when compared with both the cost of labour that would be required to segregate demolition wastes for recovery, and the financing costs associated with the additional time that increased waste reduction activity would require.

Nonetheless, large scale materials recovery by the industry (e.g., metal cladding from industrial buildings, or concrete materials that can be used for fill) continues to be practical. Wood is seldom recovered today however, and is taken to disposal facilities in a crushed and broken form mixed together with miscellaneous debris. Each company contacted estimated wood waste at between 50 and 70 percent of the demolition waste hauled to landfill.

4.3.3.3 Construction

Wood wastes generated by residential construction activities are generally clean and uncontaminated by other materials, and to this extent have high technical potential for 3Rs activity; exceptions are plywood and particleboard, which contain glues that may affect 3Rs potential. Typically, no effort is made to reutilize these wood wastes beyond ad-hoc scavenging by employees for firewood or other personal uses. Once mixed with other wastes, construction wood wastes may be economically inaccessible for more comprehensive 3Rs activity. Virtually all the construction wood wastes identified in Table 3-1 are managed by landfilling.

Discussions with construction companies indicate that very little wood waste generated in this sector is reused, recycled or recovered. Some composting of wood waste is occurring in the Hamilton area and endcuts are used in fireplaces. Fireplace use is limited because most construction waste is generated during the summer months, and the demand for firewood is limited to the winter months. Of the 70,900 BD tonnes of residential construction wood waste generated annually, it is estimated that less than 5,000 BD tonnes were reutilized in 1988. The remainder was disposed of in landfills.

4.3.3.4 Conservation Authorities and National/Provincial Parks

As recreational/natural areas, Conservation Areas and Parks have immediate recreational/ecological applications for the wood waste they generate. Most wood waste generated by Conservation Areas and Parks is managed through making wood available as firewood for campers using wood wastes for rehabilitation and enhancement of habitat or using wood wastes as protection for trails. The natural degradation on the forest floor is also a beneficial "use" of wood wastes. An estimated 6 percent of the 900 BD tonnes of wood waste generated annually by Conservation Areas and Parks in southern Ontario is estimated to be disposed of in landfills.

4.3.3.5 Municipalities

Few municipalities reported reutilizing any of their wood waste. Based on inventory data, it is estimated that about 20 percent of wood waste generated by municipalities is reutilized, often for use in parks, composting, as firewood or as farm animal bedding material for farmers. The remaining 80 percent is landfilled.

4.3.3.6 Wood Container, Secondary Wood and General Manufacturing Industries

An estimated 60 percent of wood waste generated by the wood container industry is reutilized. An estimated 46 percent of wood waste generated by the secondary wood and manufacturing industries is reutilized.

Wood waste management practices in the wood container and secondary wood manufacturing industries are generally similar to those of the primary wood industry. Wood chips, sawdust and shavings are reutilized in similar ways to the primary wood industry. In addition, however, there is widespread use of wood pieces and end-cuts by employees as fuel for domestic heating. Recovery of wood wastes from these generators is undertaken to a limited extent by intermediate processors who chip or hog the wood wastes for application in particleboard manufacture or large scale energy recovery. There is potential for additional 3Rs activity with

respect to wood wastes generated by these industries.

Wood waste 3Rs practices among other manufacturing companies are generally not widespread. Companies generating large quantities of softwood pallets and skids, however, may recycle these through a pallet refurbisher. The largest generators of these types of material are the automotive industry and other industries where a principle activity is the assembly of components that are delivered on skids or pallets.

4.3.3.7 Commercial Landscaping

As estimated 47 percent of wood wastes generated by the commercial landscaping industry are estimated to be reutilized. Tree limbs are given away or sold as firewood. Other wood wastes may be mulched or chipped for landscaping applications.

4.3.4 Wood Waste Management in Northern Ontario

In northern Ontario, the Ontario Forest Industry Statistics published by MNR indicate that 633,000 BD tonnes of the 749,000 BD tonnes of wood waste generated by the primary forest products industries were reutilized in 1986. Energy recovery either on site or off site accounted for most wood waste reutilization.

Of the 96,000 BD tonnes of wood waste estimated to be generated in northern Ontario outside of the primary forest products industry, it is estimated that 25,000 BD tonnes are reused, most commonly for heat recovery. Overall, it appears that 78 percent of wood waste generated in northern Ontario is reutilized, based on 1986 primary forest industry wood waste data. Remaining non-utilized wood waste identified in this study amounts to an estimated 187,000 BD tonnes. The Ministry of Energy has estimated unutilized wood waste generation in Northern Ontario at 304,000BD tonnes in 1986, and 245,000 BD tonnes in 1987.

4.4 Wood Waste Disposed of in Ontario

An estimated 912,000 BD tonnes of wood waste (42 percent) generated in southern Ontario is estimated to be reutilized. An estimated 658,000 BD tonnes of wood waste (78 percent) generated in northern Ontario are reutilized. Of all wood waste generated in Ontario, it is estimated that 1.570 million BD tonnes of wood waste (52 percent of wood wastes generated) are reutilized.

The remaining 1.422 million BD tonnes (49 percent) of wood wastes generated are discarded without any reutilization.

5.0 CASE STUDIES

Five case studies are presented in this section as illustrations of current and potential wood waste reutilization activities. The case studies selected represent waste reutilization activities/opportunities with respect to the broad range of types of wood waste generated. To the extent possible, outlines are provided of the background to each initiative profiled, the technical and economic aspects of each initiative, and the potential for each of the initiatives to impact on wood waste quantities in the future. Two case studies are provided of waste reduction activities in the primary forest products sector, two case studies are provided of urban wood waste reduction activities and one case study assesses the potential for an energy-from-wood waste plant.

5.1 Primary Forest Products Wood Waste

The sawmill industry in southern Ontario is concentrated in the MNR Algonquin Region, particularly in the vicinity of Pembroke. In the Algonquin Region, harvesting of softwoods predominates, with red and white pine being the principal species. In more southerly Regions, hardwoods account for larger proportions of wood waste.

Trees that are logged generally arrive at the sawmill delimbed in partial preparation for the conversion of the whole round tree into lumber. Sawmill processes vary according to the lumber products manufactured; processes include debarking, breakdown, edging, trimming, planing and other functions. These products all involve sawmills and produce waste such as bark, sawdust, shavings, hogfuel and end cuts/offcuts which are normally turned into chips. Industry representatives report that between 20 and 40 percent by weight of a log delivered to a sawmill typically becomes wood waste during sawmilling processes. Forestry operations associated with tree harvesting also generate wood waste, although the Ministry of Natural Resources favours leaving unused branch and leaf matter from logging operations on the forest floor so that decomposition will maintain soil fertility, thereby ensuring regrowth of the forest.

There are a wide range of practices that can be undertaken within the industry to minimize wood waste generation. Logging operations can ensure that trees and saplings not of value to the industry are left intact in their original habitat. Clear-cutting, which results in significant wood wastage, is widely practiced in northern Ontario and, within the study area, is practiced in the Pembroke area.

At the sawmill, wood wastage is related to the technology used and the skill of machine operators in maximizing volume recovery from the logs that are processed. Wood loss during sawing can be reduced by using narrow sawblades, minimizing sawing allowance and minimizing the planing required to produce an acceptably finished piece of lumber. Advanced technologies, such as curve sawing and other computerized systems, are now available to assist in meeting these objectives, but increased operator training is required to ensure the effective use of these systems once they have been installed.

Technology exists to assist in maximizing edging and trimming efficiency, although the technology is generally expensive and cost effective only for larger sawmills. Lasers can also be used to assist in the alignment of rough lumber on edger feeder rolls. Although technology exists in these areas to improve efficiency of sawmill operations, discussions with the industry indicate that sawmill employees may be poorly trained in the application of the technologies and that sawmill operators are not sufficiently sensitive to the losses that can occur during sawmill operations. One mill improved before-tax profit by $210,000, as well as reduced wastage, as a result of improved technology application and operator training.

Two case studies are presented that illustrate the potential for reusing and recycling wood wastes. In the first of the case studies, the markets available for wood waste generated by a sawmill are described. In the second case study, the implementation of a new forest industry technology utilizing wood waste is presented.

5.1.1 Willard Hallman Lumber

Willard Hallman Lumber is a sawmill located in Petersburg, 10 km west of Kitchener. The sawmill receives logs harvested in woodlots in an area bounded by Niagara Falls, Sarnia and Parry Sound. Hardwoods such as ash, basswood, beech, elm, maple, oak and white birch are processed at the mill. The mill produces between 24 and 70 m^3 of lumber per eight hour shift, primarily as board products.

A standard sawmilling process is followed at the mill. Logs are debarked and sawed into boards, which are trimmed (edged) to size. Off-cuts from edging are chipped. Boards are bundled according to grade and species, and are shipped to market. The process generates an average of 550 green tonnes of wood waste per month. Wood waste composition is estimated to be 60 percent wood chip, (335 green tonnes), 25 percent bark (130 green tonnes) and 15 percent sawdust (85 green tonnes). Wood waste represents about 20 percent of the weight of logs received at the mill.

Markets have been identified for almost all wood wastes generated at the mill. Wood chips are in demand from three sources. During the spring, summer and early fall, wood chips are sold directly to landscapers for $10/cubic yard. The majority of the wood chips are sold in bulk to landscapers that pick the material up at the mill site; garden centres also purchase wood chip and package them for sale. When production of wood chips exceeds demand by the landscaping business, excess wood chips are shipped to a veneer plant where they are used as fuel.

During the late fall and winter, when demand for wood chips from the landscaping industry is low, wood chips are sold to IKO in Brampton for pulping. Hallman has an agreement to deliver a maximum amount of chips per week to IKO. This varies annually according to demand by IKO; however, Hallman's wood chip production typically exceeds the amount that can be delivered to IKO, and excess chips are sold to the same veneer mill as provides the secondary summer wood chip market. Wood chips are sold to IKO for approximately $60/bone dry tonne. Hallman hauls all their own wood chips to end use markets.

The management of sawdust and bark is provided by a local hauler who specializes in the hauling and marketing of wood waste material. Sawdust is sold to the hauler between 6 and 8 cents per cubic foot. The hauler has established markets for sawdust in the agricultural community, where it is used for animal bedding. Markets are located within a radius of 80 km from the sawmill and sawdust is delivered to the farms in bulk by the truckload. The price of sawdust to the farmer varies according to the haulage cost necessary to deliver the sawdust, but is commonly in the range of $100 per 15 cubic yard load.

A small amount of sawdust (typically 30 - 45 cubic yards per week), is sold direct to local farmers by the mill. The cost of sawdust to local farmers is in the 6 - 8 cents per cubic foot range and they are responsible for hauling the material themselves.

In recognition of the low market price associated with bark, the mill allows the hauler to remove this material without charge. Some bark is mixed with sawdust up to a 1:1 ratio. Other bark is sold to a pallet manufacturer in Listowel, who uses it for its energy value.

Contract arrangements between the mill, end users and intermediate markets that utilize the wood wastes are generally informal. An exception occurs with respect to the sale of wood chips to IKO, where IKO identifies the maximum amount of material it will accept per week. In spite of the informality of contracts, however, the virtually complete reutilization of wood waste is accomplished on an on-going basis. Key to this success is the ability of the wood waste hauler to identify and serve markets.

5.1.2 Combiboard, Bancroft

The Combiboard plant in Bancroft is a new facility that uses large amounts of wood waste and recovers process wood wastes for energy recovery. The facility manufactures a product that is similar to particleboard.

The plant is owned by D & E Wood Industries, a large furniture manufacturer based in Mississauga with several other plants located in southern Ontario. The company identified the potential of manufacturing the 'combiboard' product in Ontario after learning of a similar product being manufactured in Europe. A pre-feasibility analysis was conducted to identify potential wood waste supply, available technologies and costs, and potential markets. The decision to proceed with the facility was contingent on financing availability for the $45 million dollar investment required; provincial and federal financing of $6.8 million was obtained, and remaining financing was obtained from the commercial banks.

The facility requires a manufacturing process feed of 150,000 green tonnes per year of softwood chips and a similar amount of mixed hardwood/softwood sawdust. An additional 30,000 green tonnes of bark is used as fuel for the plant. Waste from the plant, which consists almost entirely of sawdust from the sanding of finished product, and other wood wastes are also used as fuel for the plant.

All feed and fuel materials brought to the plant are wood waste materials from sawmills and other wood using industries; wood waste suppliers are located within a radius of 125 km of Bancroft. Combiboard pays in the range of $15 - 20 per tonne for sawdust and in the range of $40 -50 per tonne for wood chips; transportation costs must be paid by wood waste suppliers from these revenues. Bark is obtained for a price equal to the cost of haulage.

The company has a high level of certainty that the required wood waste quantities will continue to be available well into the future. Wood waste is supplied by approximately 40 companies, some of whom are signed to contracts and others of whom supply wood wastes on an "as available" basis. Contracts are normally arranged on an annual basis.

In the event that wood waste from existing suppliers was unreliable or could not meet the demands of the plant, the company could turn to other existing, but as yet untapped, sources of supply. The company estimates there is at least another 50,000 green tonnes of unutilized wood waste within its 125 km purchase radius, and probably considerably more. This wood waste is hard to access, however, because it is typically generated by small, often seasonal,

sawmill operations. Many of these generators, and some larger ones the company has contacted, have not been interested in selling their wastes to date because management of their wastes is not an issue with them and because they do not want the obligations associated with being a supplier.

There are two other options to ensure supply of wood waste. Poplar, which is currently an under-utilized tree species, could be harvested and chipped. Alternatively, wood waste could be obtained from urbanized areas of southern Ontario, including the Metro Toronto region, provided this wood waste was chipped and uncontaminated by nails, chemicals and other materials. With the current high tipping fees in many parts of urban southern Ontario, the haul of wood wastes to Bancroft could be economically attractive for a supplier; All-Waste Removal, a York Region and Metro Toronto waste hauler specializing in wood waste recovery, has already been a supplier of wood waste material to Domtar's particle board plant in Huntsville. The cost to All-Waste Removal to haul wood waste from a generator to their yard and to process wood waste into a form that is usable is in the $20 - 30 per tonne range, depending on the source of the wood waste and the amount of processing required.

The Combiboard product differs from particle board in that the core of the board is manufactured from flaked chips, rather than shavings as are used in other particle board products. After being flaked, the wood chips are compressed and dried, and glue is added; this will form the core of the Combiboard. On a separate processing line, sawdust is refined and dried, and glue is added to it as well; this will form the outer layer of the combiboard. The core and outer layer processing lines then come together and the sawdust outer layer is added to the top and bottom of the chip layer. The board is then pressed to its final specification thickness, sanded and finally cut to standard 4'x 8' or other specified size.

The furniture industry is expected to provide a market for 80 - 90 percent of the facility's projected annual full capacity production of 142 million square feet. The construction industry will provide a market for the remaining 10- 20 percent of production.

The advantages cited by the manufacturer for the combiboard product over particle board are that it is lighter and more flexible, while retaining sufficient strength. The company projects that 75 percent of its product will be used in Canada, principally Ontario and Quebec, and the remainder will be exported to the U.S. initially, but with a view to exploiting overseas markets, particularly in Japan.

5.2 Management of Waste Wood Pallets

Pallets and skids are widely used in the packaging of industrial and consumer products. The widespread use of pallets has led to the establishment of a pallet manufacturing industry in Ontario that includes a significant recycling sector. The Canadian Wood Pallet and Container Association (CWPCA) has 52 Ontario pallet manufacturers as members and estimates this represent about 80 percent of pallet manufacturing in the province. The size of the recycling sector of the industry is not known, but includes at least 30 companies, according to the CWPCA, and a number of other organizations providing employment opportunities for disadvantaged groups. An estimated 3 percent of discarded pallets are recycled.

There are several different kinds of pallets. These may be softwood or hardwood pallets. Softwood pallets are manufactured from pine, spruce, fir or poplar; hardwood pallets are manufactured from oak, maple and beech. In terms of application, the principal distinctions between these pallets are cost (softwood is cheaper) and strength/durability (softwood is weaker and less durable). From a waste management perspective, the principal distinction is that hardwood pallets are returnable, whereas softwood pallets are generally designed as "one-way" and are discarded following use.

The CWPCA estimates that over half the pallets used in Ontario are used in the automotive and related industry; this industry is a major user of softwood pallets, but also uses hardwood pallets where load requirements dictate. Approximately one third of pallets used in Ontario are used in the grocery and consumer products industry; in this industry, particularly the grocery sector, the use of hardwood returnable pallets is common. Other significant users of pallets include the defence and mining industries.

The pallet industry has experienced growth averaging 8 percent per year since 1983. However, the industry is undergoing technological change as it grows. New pallet technologies are challenging established pallet manufacturers. Plastic pallets have been introduced in some applications, but performance has not been fully satisfactory. Similarly, particle board pallets have had performance problems. Neither pallet type is as recyclable as wooden pallets. Nail-less pallets are now being introduced to the market place.

While new technologies are competing with established pallet manufacturing, however, a potentially more serious issue for wood pallet manufacturers relates to the significant impact of the pallets on the quantity of industrial waste requiring management. The ratio of pallets used to pallets recycled is estimated at 33:1. Although wood pallets are recyclable, there are significant barriers to increasing the level of recycling that actually takes place, as outlined in the next section.

Two initiatives can be mentioned, however, that suggest ways in which used pallet waste can be controlled. The automotive industry is currently developing standards for pallet use associated with automobile components. This initiative is designed to standardize pallet use throughout the automotive industry. Identifiable standards will serve as a significant market development initiative for pallet recyclers.

Pallet leasing is also undertaken. Both the Canadian Pallet Council and CHEP Canada, a private company, operate programs that lease pallets to major pallet users. The primary market for this service is the grocery business; each of the major grocery retailers belong to one or other of these programs. In both cases, hardwood pallets are leased and the leasing company undertakes all repair and maintenance functions. This concept could be extended to a range of additional pallet users.

5.2.1 Used Wood Pallet Management in Essex-Windsor

Wood pallets are used for the packaging/transportation of a wide variety of industrial and consumer goods. In Essex-Windsor, the principal use of wood pallets is to facilitate safe and secure movement of automotive components. Secondary uses of pallets are in the retail appliance and grocery industries.

The wood waste inventory has identified an estimated 8384 BD tonnes of waste wood pallets annually in the Essex-Windsor area. Traditionally, the means of disposal of waste pallets has been landfilling. Other options are possible, however, including refurbishing, composting and combustion.

5.2.1.1 Refurbishing

Pallet refurbishing is undertaken across southern Ontario. The process typically requires that incoming pallets are stored, broken boards are removed and replaced with good boards, and the pallet is returned to the market place. Pallet repair is not a technically skilled industry but a labour intensive industry characterized by low profit margins and a large land requirement.

New pallets cost in the range of $7 to $11 depending on the size of the pallet; by contrast, refurbished pallets cost in the range of $5 to $7. Purchase of waste pallets may be required in order to ensure supply. Pallet refurbishing is often undertaken by organizations with low wage and profit requirements, such non-profit organizations providing employment for the disadvantaged.

Used, non-returnable pallets in the Essex-Windsor area may be purchased for $75 - $100 per trailer load for approximately 400 pallets or 40 tonnes of wood. Typically, 80 percent of wood, non-returnable, pallets can be refurbished; the remaining 20 percent are stripped, and sound boards are used to repair pallets to be refurbished. In total, 7 - 10 percent of used pallets received are discarded from the refurbishing process as scrap.

Capital requirements for pallet refurbishing are modest. The principle technology requirement is an un-nailer to disassemble pallets. Capital costs for this technology are in the range of $15,000 - $26,000 for a machine to process up to 3,000 pallets per week. Even this capital cost can be avoided if more labour intensive, but ultimately more expensive, approaches are used.

A ready market exists in Essex-Windsor and in adjacent areas of Ontario and the U.S. for refurbished pallets. However, there is a tendency for pallet users to prefer new pallets because of concerns over refurbished pallets to perform as well as new pallets. This concern is generally perceptual, and is being overcome as refurbished pallets demonstrate their utility in the marketplace.

5.2.1.2 Composting

The composting of wood waste has been undertaken for several years in Ontario. Currently, there are several large wood waste composting projects underway in the province, including Philip Enterprises in Hamilton and Hillview Farms in Woodstock, both of which compost up to 10,000 tonnes of wood waste annually, and White Rose Nurseries near Uxbridge, where 3,000 tonnes of wood waste are composted annually. Other significant wood waste composting projects include the composting of a paper mill sludge rich in wood fibre by Grow-Rich in the Region of Niagara and, recently, projects by the City of Gloucester and the City of Windsor, which have used wood chips in sludge composting.

Outdoor Composting: Outdoor composting can be readily undertaken in southern Ontario, particularly in the relatively mild climate of Essex-Windsor. For a number of years the City of Windsor successfully conducted outdoor composting of sewage sludge. Commonly, organic matter is piled into windrows where composting takes place over a 6 - 12 month period. Successful outdoor composting requires readily compostable material, correct chemical balance, particularly with respect to carbon and nitrogen, and aerobic conditions.

The composting of wood pallets would require the processing of the pallets into a form that could be readily composted. The amount of processing required would depend on other aspects of the composting project. Where the primary material to be composted has a high moisture content, processed pallets could play a dual role of drying agent and bulking agent.

Pallets pulverized to a fine flake or particle size would have high water absorption capacity and would be an effective drying agent. Sawdust can also be a useful drying agent, depending on its moisture content. Green sawdust commonly has a moisture content of 50 percent, however, if the sawdust has been stored outside it may have a higher moisture content. It is not necessarily as useful as a drying agent, therefore, as pulverized wood pallets at, perhaps 20 percent moisture. Any decision to use sawdust or pulverized pallets as a drying agent in a composting project will depend on the availability of both sawdust and pallets.

The use of more coarsely processed pallets may be appropriate as a bulking agent in composting projects. Bulking agents are necessary where the primary material to be composted is not conducive to air circulation; the presence of oxygen throughout a compost pile or windrow is essential to maintain the composting process. Wood chips are commonly used as bulking agents in compost projects. However, wood chips are in high demand by the pulp industry and may not be readily available.

Two other issues would also need to be addressed in order to process used wood pallets for composting operations: removal of nails and the possible need for a double-processing system in order to produce an acceptable sawdust substitute. Nails can be removed by a magnet following the size reduction of wood pallets. Additionally nails can be removed when the compost material is screened following completion of composting.

The need for a double processing system to reduce used pallets to an acceptable size would depend on the requirements of the compost system. While wood waste hoggers, hammermills, grinders and shredders accomplish size reduction of wood waste, it may be necessary to process used pallets into a oversized coarse material prior to final preparation into the dimensions required. This is particulary true for achieving a sawdust substitute from whole

pallets, but would not necessarily be required where a sawdust substitute was prepared from broken pallets or pallet boards.

The economics of using processed pallets as drying agents and/or bulking agents can be competitive with sawdust or wood chips. Sawdust and wood chips may cost up to $40 per green tonne on the open market. The cost of processing wood pallets into a sawdust or wood chip replacement material can be competitive with these costs, particularly if the cost of processing is off-set by the averted waste management cost that the waste pallet generator would otherwise have paid.

Enclosed Vessel Composting: Used pallets can also be composted in enclosed vessels. Several enclosed vessel composting technologies are available. The principal advantage of these technologies over outdoor windrow composting is the speed with which finished compost can be produced; commonly, enclosed vessel composting can produce finished compost in 28 days, as opposed to the several months required for outdoor windrow composting. Enclosed vessel composting is capital intensive.

The composting of used pallets by enclosed vessel composting would require the size reduction of the pallets. The maximum size reduction of pallets that is economically feasible for a specific composting project is desirable for in-vessel composting. Depending on the moisture content of the primary composting feedstock, pulverized used pallets may be useful in the composting process to correct moisture imbalances that would otherwise occur. The need for bulking agents is specific to particular composting technologies. Some technologies that include an aeration system in the process eliminate the need for bulking agents in the compost feedstock.

Quality Control: Compost quality control is essential to ensure that finished compost is not contaminated with heavy metals or other potentially toxic material. From a wood waste perspective, it is important that wood waste feedstock not contain preservatives, creosote or other material that could contaminate finished compost. Used pallets generally do not contain impurities of these kinds unless contaminants have been spilled onto them.

Potential Impact On Used Wooden Pallets A survey conducted by the Essex-Windsor Waste Management Committee in 1988 identified that approximately 5000 tonnes of landfilled compostable waste is generated annually by industrial/commercial sources. If drying and bulking agents were required in the composting of this material at a level of approximately one-third of this amount, up to 1750 tonnes of used wood pallets could be composted.

5.2.1.3 **Recovery of Pallets for Energy Value**

The 8384 BD tonnes per year of used pallets generated in Essex-Windsor have an energy value of approximately 210,000 GJ. The recovery of used pallets for utilization of their energy value would require:

- processing of the pallets into a form suitable for feed into a boiler;
- retrofitting/implementation of boiler systems to accept processed used pallets; and
- identification of energy markets to utilize used pallets.

The requirements for processing of waste pallets into a form suitable for fuel are similar to those associated with preparation of waste pallets for composting. Waste pallets would require size reduction which, depending on the energy recovery system selected, may require two step processing. Technology is available, however, to process pallets into wood chips of less than 3 inch diameter. A second processing step is required if a chip size of less than 0.5 inches is required.

The need to install a new boiler system to burn wood waste is a function of the existing boiler type at a facility. Coal boilers can be converted to burn wood waste. However, existing oil or gas energy systems would have to be replaced or supplemented with wood waste burning technology.

Other equipment needs may include wood waste storage structures, feed conveyors and the piping, exhaust and electrical systems necessary to implement a wood waste energy recovery project.

Numerous potential markets exist in Essex-Windsor for the application of wood waste energy recovery projects. The most desirable markets are those that have a high energy demand throughout the year. Industries that incorporate a drying process in their operations represent a suitable market, as do those with consistently high steam demand.

Other types of industry may also be acceptable wood waste energy markets. In Essex-Windsor, the agricultural industry may, in particular, provide a significant market for wood waste energy recovery for the heating of greenhouses (during the winter). The provision of adequate winter heating is a major operational cost of the greenhouse industry; it is likely that the potential cost-savings associated with wood waste energy recovery would be of interest to those operators.

In order to identify the financial costs associated with wood waste energy recovery projects utilizing waste pallets, the data in Table 5-1 is useful. These represent the approximate costs associated with an energy recovery system providing 1,000,000 Btu's per hour utilizing used pallets at an assumed average moisture content of 20 percent.

5.3 Manufacture of Fire Logs from Wood Waste

The fire log industry is comprised of companies that use sawdust and wood chips/shavings in a manufacturing process to produce a dense wood or wood/wax "log-shaped" product that can be sold as an alternative to natural fire wood. The most common sources of raw materials used in the wood densification process are saw mills and urban secondary wood industries. Fire logs are commonly sold in grocery stores, departments and convenience stores.

Table 5-1

Approximate Costs Associated With
Implementation Of A Used
Wood Pallet Energy Recovery Program

Storage Structures	$ 10,000
Wood Hogger	42,000
Wood Pulverizer	30,000
Conveyor	8,000
Wood-Fired Boiler and Related Equipment	65,000
Piping, Utilities, etc.	20,000
Total Capital	**$175,000**

Notes:

1) Provision of used pallets would be an additional cost.

2) Retrofit of existing system may not require purchase of all the above items.

3) Actual costs will vary from above estimates according to specific technology/system implemented.

4) The above cost summary assumes the provision of 1,000,000 Btu's per hour using waste wood pallets containing 20 percent moisture.

With growing urban populations, access to natural wood diminishes and the fire log represents an alternative which burns longer than natural wood and is readily available in urban centres. The fire log market in the Michigan, upstate New York, Ontario and Quebec region is estimated to be equivalent to 175,000 tonnes of wood waste.

5.3.1 Monto Industries

Monto Industries of Toronto produces fire logs from clean, dry wood waste and liquid wax. The business has been in operation for ten years, and has been expanding at a rate of 10 - 15 percent per year. The North American fire log industry is valued at $80 million wholesale. Monto Industries has a $2 million dollar share in the market. Their primary market, the United States, accounts for 98 percent of their business. Only 2 percent of their existing market is in Canada.

The fire log industry is seasonal, as indicated by Monto Industries production pattern. Production ceases in January and recommences in July. In the high season, which occurs from September to November, Monto Industries consumes 50 - 60 bone dry tonnes of wood waste per day and employs 13 people.

Currently, about 5,000 tonnes of their fire logs, Karepak and Flame Glo, are produced annually. A capital investment of one million dollars was required to establish this level of production. To produce this quantity of fire logs, 2,000 oven dry tonnes of wood waste (10% moisture range) are required. The company accepts all wood waste which is clean and dry, except bark, including end cuts from furniture manufacturers and mill sawdust. Their wood waste is supplied by H.R. Trucking, Ontario Sawdust Supply and Bulk Shaving Ltd. at a cost of $30 - 40 per bone dry tonne. Monto Industries relies on brokers to supply the wood waste. A sister company markets the product.

The process of fire log manufacturing involves:

1) grinding of clean, dry wood waste into sawdust;
2) weighing wood waste;
3) proportionately mixing wood waste with hot, liquid wax (40 - 43% wood waste and 57 - 60% wax by weight);
4) cooling the mixture;
5) extruding to form into fire logs;
6) weighing of each fire log;
7) packaging; and
8) storing and shipping.

It appears as though most fire log manufacturers can use wood waste in the form of wood chips and sawdust, although the machinery used by a particular company may not permit the use of sawdust, as in the case of Kelly's Forest Fuel and Transfer Company.

All-Wood Products, located in Concord, maintains year round operation by producing fire logs during the winter and compost from wood waste available in the summer. Eco-Wood Products supplies wood wastes to this company at a cost of $30 per tonne. From September to January the company accepts 10 tonnes of wood waste per day for the production of fire logs. Their logs are marketed in chain stores such as A & P. Estimates of wood waste used for composting are not available.

5.4 Large Scale Recovery of Energy Value From Wood Waste

Large-scale combustion of wood waste has been identified as a technically proven concept and is widely used throughout the country either in new specially designed boilers or in modified existing boilers. Main advantages of energy from wood waste are:

- reduction of wood waste volume and therefore reduced requirement for landfill;

- use of available energy in wood waste that would be otherwise lost;

- conservation of fossil and other fuels (gas, oil, coal, nuclear);

- potential to reduce haul costs; and

- security of supply.

Main disadvantages are:

- high capital cost; and

- potential air pollution impacts if not properly designed, operated and maintained.

5.4.1 Potential For Energy From Wood Waste at CFB Petawawa

CFB Petawawa have indicated that the saturated steam at 827 kPa pressure produced in their natural gas/No. 2 oil-fired boilers is being used 90% for heating and 10% for domestic hot water. Steam for the facility requirements is produced by an existing boiler plant composed of four boilers: two rated at 2108 x 10^4 kj/kg and two rated at 948.6 x 10^4 kj/kg. The two smaller boilers produce steam primarily during summer months at the rate of 45% of design capacity, while two larger ones are used only during winter months at approximately 77% of design capacity.

Steam requirements for CFB Petawawa and fuel consumption on a monthly total basis for year 1988 are presented in Table 5-2.

Confirmed annual available quantities of wood waste are identified in Table 5-3.

Table 5-2

Monthly Steam and Fuel Consumption - Year 1988

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
Steam ($x10^6$ kg)	21.99	20.70	19.44	13.80	7.32	4.21	3.88	3.71	4.81	13.45	15.33	20.57	149.21
Natural Gas ($x10^6$ m^3)	1.19	1.30	1.44	1.01	0.56	0.33	0.30	0.30	0.42	1.02	1.17	1.33	10.37
No. 2 Oil ($x10^4$ L)	37.97	16.29	-	-	-	-	-	-	-	-	-	18.76	73.02

Table 5-3

Wood Waste Generated By
53 Sawmills In Renfrew County

Waste Type	Quantity (000's of BD tonnes)
Hardwood:	
Bark	80
Sawdust	92
Logging Residue (Hogfuel)	207
Softwood:	
Bark	80
Sawdust	92
Logging Residue (Hogfuel)	138

Notes:

1) Wood wastes in this table are currently disposed of without reutilization.

2) Energy value of wood waste assumed to be 20,000 kj/Kg.

Source:

County City Development Committee, County of Renfrew/City of Pembroke, Pembroke, 1988.

In order to define the approximate annual wood waste requirements necessary to satisfy CFB Petawawa steam demand, the following formula was used:

$$\frac{\text{Annual steam demand (kg/yr) x Heat input requirement (kj/kg)}}{\text{Thermal efficiency x Wood heating value (kj/kg) x 1000 kg/tonne}} = \text{Wood required (tonne/yr)}$$

where:

- Heat input requirement (heat that must be added to the boiler feedwater in order to generate saturated steam) estimated to be 2233 kj/kg.

- Thermal efficiency for wood fired boiler estimated to be 65% (Normal variations expected between 60-75%).

- Average estimated wood waste calorific value at zero percent moisture - 20,000 kj/kg.

$$\frac{149.21 \times 10^6 \text{ kg/yr} \times 2233 \text{ kj/kg}}{0.65 \times 20{,}000 \text{ kj/kg} \times 1000 \text{ kg/tonne}} = 25{,}630 \text{ BD tonnes/yr.}$$

Therefore, it is estimated that the annual energy requirement of CFB Petawawa could be met through the recovery from 25,630 BD tonnes of wood per year. As indicated in Table 5-3, this supply is readily available.

Using the same formula, the maximum and minimum monthly wood waste quantities at zero percent moisture are established:

a) Maximum monthly wood waste requirements: 3781 BD tonnes/month.

b) Minimum monthly wood waste requirements: 637 BD tonnes/month.

Based on available information, it appears that existing boilers can, with minor modifications, be easily transformed to boilers burning specified wood waste. Also, it appears that the existing boilers were not designed to produce the high pressure superheated steam (approx. 4480 kPa) that is necessary for co-generation of electrical power. Thus the possibility of installing an extraction type turbine/generator system without major system redesign is eliminated.

The basic auxiliary elements to be added to the existing boiler plant would be:

a) Wood waste storage and handling
b) Boiler/economizer cleaning system
c) Flue gas cleaning system
d) Ash handling and storage system

Wood Waste Storage and Handling System

Wood waste with the moisture content of approximately 50% would be delivered by trailer truck and unloaded into the enclosed primary storage area. Assuming that there is an average density of 2,405 kg/m^3 for the mixture of available types of wood waste, wood waste storage of 17,097 m^3 would be necessary for the maximum monthly wood waste requirement; storage of 3747 m^3 for the minimum monthly wood waste requirement would be necessary. This assumes that capacity of the wood waste storage area is equivalent to 31 days, while the plant is operating at the present maximum operating capacity.

The available wood wastes identified in Table 5-3 would not require preprocessing. From the storage piles, wood waste would be loaded by the front-end loader or crane onto an enclosed transfer conveyor to deliver material to the secondary storage bin located adjacent to the boiler. The capacity of the secondary storage area could be for approximately 4 to 5 hours

of the boiler operation at the maximum wood waste firing rate.

Boiler/Economizer Cleaning System

The existing boiler and economizer should be equipped with the same means of gas-side tube cleaning (e.g. retractable sootblower using compressed air or steam) for wood waste burning application. The selection of a specific cleaning system would be the subject of further detailed studies.

Flue Gas Cleaning System

The flue gas cleaning system for this application would be mandatory in order to meet the requirements of the Regulation 308 under the Ontario Ministry of the Environment's Environmental Protection Act. Under the current regulations, the half-hour average particulate concentration at point of impingement should not exceed 100 ug/m^3. Therefore, the relationship between particulate emission rate and the stack height should be established in such a way to ensure that MOE criteria are met.

Several control devices are available for particulate removal from the flue gas stream:

- cyclones or multicyclone;
- electrostatic precipitator;
- wet scrubber;
- quench tower and fabric filter.

The selection of the control device that is the most appropriate for the given application would be the subject of further detailed studies. Current initiatives to amend O.Reg. 308 of the Environment Protection Act are likely to result in stricter emission control requirements than exist today.

Ash Handling and Storage System

All the collected ash, including quenched grate ash, would be conveyed by a common system and discharged directly to the ash storage silo. Ash from various collection points is typically discharged first onto the local enclosed common conveyor. The ash is unloaded periodically from the storage silo to the truck. Ash could be disposed of in a sanitary landfill; consideration could also be given to the agricultural application of ash given the beneficial impacts of wood ash on soil quality.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

Estimates of wood waste generation in northern Ontario have been based on available data on wood waste generation by the primary forest products industry, together with data pro-rated to reflect northern Ontario based on the southern Ontario data base.

It is estimated that 2.147 million bone dry tonnes of wood waste were generated in southern Ontario in 1988. An estimated 0.845 million bone dry tonnes of wood waste were generated in northern Ontario in that year. Total wood waste generation in Ontario is estimated at 2.992 million tonnes in 1988.

Wood waste reutilization initiatives are common among many wood waste generating sectors. In southern Ontario, 0.912 million bone dry tonnes (42 percent) of generated wood waste are estimated to have been reutilized in 1988. The corresponding figure for northern Ontario is estimated to be 0.658 million bone dry tonnes (78 percent) of wood waste generation. In total, 1.570 million bone dry tonnes of wood waste that were generated in Ontario in 1988 are estimated to have been reutilized in 1988, representing 52 percent of wood waste generation. The remaining 48 percent of wood waste estimated to be generated in Ontario, amounting to over 1.4 million bone dry tonnes, is discarded without reutilization.

Significant opportunities exist to enhance wood waste reutilization. In order to contribute to the greatest extent possible to the Ministry of Environment's goal of diverting 25 and 50 percent of waste from disposal by 1992 and 2000 respectively, however, efforts to enhance wood waste reduction activity need to be coordinated into a strategy and action plan that has the support of all key stakeholders. The recommendations that follow describe how this should be achieved.

7.2 Recommendations

The recommendations that follow are divided into strategy and policy recommendations, and those that pertain to specific types of wood waste or specific categories of wood waste generator.

Strategic and Policy Recommendations

1. The 3Rs hierarchy is as relevant for wood waste management as for the management of other wastes. This hierarchy of management priorities represents an environmentally sensitive management philosophy, advancing towards sustainable development. This hierarchy should therefore be applied into wood waste management options.

2. The Ministry of Environment, together with the Ministry of Energy, should immediately stage a conference targeted at wood waste generators and users to communicate the findings of this report and to explore possible directions and actions to increase wood waste reutilization.

3. Following the conference proposed in Recommendation 2 the Ministry of the Environment together with the Ministry of Energy, should create a multi-stakeholder Task Force on Wood Waste Reutilization. The Task Force should consist, at a minimum, of representatives from the Ministry of the Environment, Ministry of Natural Resources, Ministry of Energy, Ontario Hydro, municipalities, the principal wood waste generating industry sectors, consumer groups and environmental groups. Within six months of formulation, the Task Force should present to the Minister of the Environment and the Minister of Energy a "Strategy and Action Plan For Wood Waste Reutilization in Ontario" that represents actions, schedules and objectives recommended by the Task Force on measures to increase wood waste reutilization.

4. The strategy and action plan should cover at least the 1990 - 2000 period. The strategy and action plan should have the goals of both maintaining current levels of

wood waste reutilization and reutilizing at least 25 and 50 percent of remaining wood waste being discarded by 1992 and 2000 respectively.

5. The wood waste data base that has been initiated with this report should be regularly updated and refined by the Ministry of the Environment.

6. Given the evidence of potential uses for wood waste, the Ministry of the Environment should consider measures to ensure that only wood wastes that are contaminated in such a way as to prevent reutilization should enter disposal facilities. These measures should include consideration of mechanisms to require wood waste reutilization if wood waste generators do not make significant progress in increased reutilization of wood waste materials. All players in wood related industries must be made aware that, given the current state of the environment, wood waste should be used to its highest potential.

7. Opportunities should be pursued to divert wood waste from disposal to productive reuse. For example, agricultural lands in Ontario are severely depleted of organics, so making compost from wood waste for which there is a poor market should be encouraged. The wood waste problem would be addressed while improving the condition of agricultural lands. Another example, the use of sawdust as bedding for animals represents an environmentally efficient use of a resource. The sawdust is reused as bedding and is then returned to the soil where the nutrients are recovered.

8. The Ministry of the Environment, together with the Ministry of Energy, should encourage and foster co-operative arrangements between wood waste producers, and haulers/users requiring or potentially requiring the wood waste.

Management Recommendations For Specific Wood Wastes

The following recommendations are intended to encourage the minimization of wood waste generation and guide wood waste reutilization. While they should be considered preliminary

and subject to refinement through fulfillment of Recommendations 2, 3 and 4, they represent actions that can be taken immediately and over time to directly minimize wood waste requiring disposal.

9. The Ministry of the Environment should consider financial and other measures to discourage non-reusable pallets.

10. The Ministry of the Environment should encourage the use of chippers and other wood processing technology by generators, haulers and receivers of broken pallets and pallet pieces in order to maximize opportunities for recycling these wood wastes.

11. The Ministry of the Environment should facilitate and support the use of fire logs manufactured from wood waste for use in home fireplaces, subject to other environmental considerations such as impact on air quality.

12. The Ministry of the Environment should work with the waste management service and demolition industries to establish a network of facilities across the province to process and market wood waste.

13. Consistent with using wood waste to its highest potential (Recommendation 6), the Ministry of Energy should continue to support the recovery of energy from wood wastes, and provide focussed support for wood waste initiatives in metropolitan areas where construction/demolition wastes and manufacturing wood waste residues pose significant disposal problems. Support initiatives should emphasize energy recovery where wood waste reuse and recycling are demonstrated to be unrealistic. Appropriate support includes provision of technical data on wood waste energy recovery equipment, and capital cost financing of energy from wood waste facilities.

APPENDIX A

Inventory Survey Questionnaire

52339

Wood Waste Inventory

Data Gathering Questionnaire

Good morning/afternoon,

My name is _____ and I'm calling you from MacLaren Engineers in _____. Our firm has been retained by the Ontario Ministry of the Environment to develop an inventory of wood waste generation in Ontario. The Ministry requires this inventory to develop initiatives to recycle or otherwise use wood that is currently being thrown away by industry, municipalities, construction companies and others. This includes wood pallets, shavings, sawdust, lumber, bark or any other wood waste you may have. In relation to this study, I would like to ask you a few questions on the wood waste generated by your company. It will only take a couple of minutes, if that's okay with you.

1. What types of wood waste is generated at your plant? (eg. pallets, bark, sawdust, lumber etc).

2. Could you estimate the total tonnage of each type of wood waste generated per day/week/month/year. (IF IT IS NOT POSSIBLE TO OBTAIN A BREAKOUT BY TYPE OF WOOD WASTE, ASK FOR AN OVERALL TOTAL; IF TONNAGE FIGURES ARE NOT AVAILABLE, OBTAIN QUANTITY INFORMATION ACCORDING TO WHATEVER UNITS ARE APPROPRIATE - EG. No. OF PALLETS, TRUCKLOADS OF SAWDUST TOGETHER WITH SIZE OF CONTAINERS, INVENTORY RECORDS OF PURCHASES COMBINED WITH ESTIMATED AMOUNT OF INVENTORY RECORDS DISCARDED AS WASTE ETC).

3. Does this quantity vary seasonally? If so, how?

4. How is this waste currently disposed of?

5. What is the current disposal cost? (haulage & tipping fee)

6. Do you foresee any change in amount of wood waste generated at your plant? If so, what?

7. Do you foresee any future need to change the way your wood waste is managed? If so, what?

8. Have you ever looked at recovering your wood waste for recycling, burning or any other purpose? If yes, provide details of what was looked at and why recovery of wood waste was/was not undertaken.

.../2

WOOD WASTE INVENTORY
DATA GATHERING QUESTIONNAIRE (cont'd)

9. Are you aware of any alternate ways of managing your wood waste? If yes, provide details.

10. Would you be interested in participating in a project to recover your wood waste for recycling or some other purpose (e.g. use as a fuel)? If no, why not?

At the end of the interview, thank the interviewee for his/her time and information.

NOTES: IF A COMPANY REQUESTS ANONYMITY, ASSURE THEM THIS CAN BE PROVIDED AND SIMPLY NOTE THE TOWN/CITY OF LOCATION AND GATHER THE INFORMATION REQUESTED.

RESULTS OF THE STUDY WILL BE MADE AVAILABLE; IF A COMPANY WANTS TO RECEIVE A COPY OF THE REPORT, NOTE THIS ON THE DATA FORM.

ALL ANSWERS TO QUESTIONS TO BE ENTERED ONTO DATA GATHERING FORM.

SUMMARY OF WOOD WASTES

GENERATOR/CITY COUNTY	CONTACT	TYPE OF WASTE AND CONDITION	RAW AVE T/D	RAW MAX T/D	DRY AVE ODT/D	DRY MAX ODT/D	CURRENT DISPOSAL PRACTICE	DISPOSAL COST $/TON	FUTURE TREND	REMARKS	ALTERNATE DISPOSAL

APPENDIX B

Appendix B contains the inventory listings collected during the survey. The data is grouped according to inventory activity (i.e. manufacturing companies) and Ministry of Natural Resources regions.

WOOD WASTE INVENTORY
DATABASE RECORDS : MANUFACTURING COMPANIES
PRODUCED FOR : MINISTRY OF THE ENVIRONMENT/MINISTRY OF ENERGY
(Waste Quantities (tonnes/month))

MNR NAME / REGION	SIC CODE	COUNTY/ REGION	CONTACT NAME / PHONE NUMBER	WOOD WASTE CONDITION	AVG. RAW WOOD WASTE	MAX. RAW WOOD WASTE	AVG. AIR DRIED WOOD WASTE	MAX. AIR DRIED WOOD WASTE	AVG. OVEN DRIED WOOD WASTE	MAX. OVEN DRIED WOOD WASTE	AVG. BONE DRIED WOOD WASTE	MAX. BONE DRIED WOOD WASTE	CURRENT MANAGEMENT PRACTICE
ARCESE BROTHERS FURNITURE DIST. LTD.	25		GIUSEPPE ARCESE	SAWDUST, END-CUTS					110.00		96.80		SAWDUST SOLD, REST LANDFILLED
BOGDEN & GROSS FURNITURE COMPANY	25		GEORGE BOGDEN	SAWDUST,SHAVINGS, END-CUTS					0.25		0.22		FUEL
CHAMPION ROAD MACHINERY LIMITED	35		BRUCE GARNER	PACKING CRATES, PALLETS									DISPOSAL COMPANY
CROYDON FURNITURE	25		MR. DEAKIN	PALLETS,END-CUTS					4.20		3.70		DISPOSAL COMPANY
DEILCRAFT FURNITURE CO. LTD.	25		TOM CALLAHAN/RUSS AKERMAN	SAWDUST,END-CUTS									BURNED IN WINTER,SOLD TO FARMERS IN SUM.
DIGITAL EQUIPMENT			D. REID	PALLETS									ALL RECYCLED
DILLEX DIMENSIONAL WOOD PROD. LTD.	24		P. HAIMOS	SHAVINGS, END-CUTS					70.00		61.60		SHAVINGS(FARMER),END-CUTS (LANDFILLED)
GENERAL CHEMICAL CANADA LTD.	28		B. MATTE	SAWDUST, END-CUTS					0.10		0.09		DISPOSED IN THEIR OWN LANDFILL
GEORGE GUENZLER & SON	24		N.V. ENGLISCH 519-885-2141	END-CUTS, SAWDUST									FIREWOOD, FARMERS
HANOVER	24		LORNE E. KOENIG	SAWDUST,END-CUTS									FARMERS,FUEL AND LANDFILL

C = Central Region; SW = SouthWestern Region; E = Eastern Region; NC = NorthCentral Region; NE = NorthEastern Region; A = Algonquin Region

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DATABASE RECORDS : MANUFACTURING COMPANIES
PRODUCED FOR : MINISTRY OF THE ENVIRONMENT/MINISTRY OF ENERGY
(Waste Quantities (tonnes/month))

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	KITCHENS(CANADA) INC.													
	INTERBAKE FOODS LIMITED	20		L. KELLY	DAMAGED PALLETS									FIREWOOD
	ITT INDUSTRIES OF CANADA LTD.			B. SOOLEY 416-625-1830	PALLETS			2.50	5.00			2.00	4.00	DISPOSAL COMPANY
	JAMOT LUMBER CO. LTD.	24		ROGER FRYER	SHAVINGS, SAWDUST									SOLD TO FARMERS
	MAGNUSSEN FURNITURE MFG. LTD.	25	WATERLOO	R. MAGNUSSEN 519-662-3040	SAWDUST, END-CUTS					20.00		17.60		CATTLE BEDDING
	NAVISTAR INTERNATIONAL CORP. CAN.	37		K. PASCOE	PALLETS, TOTE BOXES			4.00	16.00			3.20	12.80	LANDFILL
	NORTH AMERICAN PLASTICS CO. LTD.	37		P. WALKER	PALLETS			2.00				1.60		RETURNED FOR REFURBISHING,EMPLOYEES
	NORTHERN TELECOM CANADA INC.	36		J.T. LIDSTER	PALLETS									FIREWOOD
	REFLECTIONS INTERNATIONAL FURNITURE	25		GLEN THISTLEWAITE 416-856-2500	SAWDUST, END-CUTS					14.50		12.76		DISPOSAL COMPANY

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(Waste Quantities (tonnes/month))

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	ROTHWELL LUMBER			MANAGER	BARK, SAWDUST	364.00						182.00		SOLD FOR WOOD WASTE BURNER
	ROY'S LUMBER & MINING TIMBER LTD.	24	BRITTANIA	VICTOR ROY	BARK, SAWDUST, CHIPS	60.00						30.00		LANDFILL AND CHIP UTILIZER(ESPANOLA)
	THE CANADA WOOD SPECIALTY COMPANY	24		LEN BOWERS	SAWDUST, SHAVINGS, END-CUTS					55.00		48.40		USED AS FUEL TO HEAT BUILDING
	WESTINGHOUSE CANADA INC.		ALL PLANTS (10)	S. DUFFUS 416-528-8811	PALLETS,SAWDUST, END-CUTS					18.25		16.06		LANDFILL OR EMPLOYEES FOR SOME WOOD PALLETS
	WILFRED KARLDON FURNITURE CO. INC.	25		W. STRYBUSCH	END-CUTS									FIREWOOD OR GIVEN TO FARMERS FOR FUEL
	WILLARD G. HALLMAN LUMBER LIMITED	24		JOHN W. HALLMAN	SAWDUST, BARK	3460.00						1730.00		ANIMAL BEDDING, LANDSCAPERS, OWN LANDFIL
REGIONAL TOTALS						3884.00		8.50	21.00	292.30		2206.03	16.80	
A	ALGONQUIN LUMBER INC.	24	RENFREW	HANSE EBRECHT	SAWDUST, SHAVINGS	292.00						146.00		BEDDING
	ALMAGUIN HIGHLANDS AMR	25	PARRY SOUND	JIM GRAHAM	SAWDUST									CATTLE BEDDING BY FARMERS

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A	ANDERSON WINDOW DIVISION	24	PARRY SOUND	NORM HARKNESS	CHIPS END-CUTS, SHAVINGS					18.00		15.84		FIREWOOD, BEDDING(CATTLE)
	ATOMIC ENERGY OF CANADA	35	RENFREW	JIM COSTELLO	FORMS, PALLETS			0.30				0.24		LANDFILL
	BEN HOKUM AND SON LTD.	24	RENFREW	DOUG WILSON 613-757-2399	SAWDUST, BARK, WOOD CHIPS	2400.00						1200.00		PULP MILLS AND FIBREBOARD MFG.
	CALEDON TIMBER PROD. LTD.	24	PARRY SOUND	SHARON BELANGER	SHAVINGS, END-CUTS, SAWDUST									HEATING KILN AND GIVEN TO EMPLOYEES
	CANADAN VENEERS LTD.	24	RENFREW	NOEL PLANTE	SAWDUST, BARK, VENEER	1125.00						562.50		BURNED IN BOILER ON SITE FOR HEATING
	CARSON LAKE LUMBER	24	RENFREW	DR. COOPER 613-687-8107	BARK, SAWDUST	400.00						200.00		USED FOR FILL ON OWN PROPERTY
	DECO LUMBER CO.	24	PARRY SOUND	BOB HAYES	SAWDUST, END-CUTS	168.00						84.00		OWN LANDFILL(WILL BE USING MUNICIPAL NOW
	FIELD LUMBER	24	NIPISING	SANDRA LONGLAND	BARK, SAWDUST, SHAVINGS, CHIPS, END-CUTS	1840.00						920.00		WOOD FIRED STEAM PLANT
	FREYMOND LUMBER	24	PARRY SOUND	DAN FREYMOND	SAWDUST, WET BARK	1636.00						818.00		SAWDUST USED AS FERTILIZER,REST LANDFILL

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A	G.W. MARTIN LUMBER	24	MUSKOKA	BOB RUTLIDGE 705-448-2330	SAWDUST, BARK, SHAVINGS	2668.00						1334.00		INCINERATED FOR HEATING
	G.W. MARTIN VENEER	24	NIPISSING	GUY LAFERRIER	SAWDUST, CHIPS					660.00		580.80		SOLD TO PAPER MILL AND BURNED IN BOILER
	GOULARD LUMBER	24	NIPISSING	S. RANCOURT	SAWDUST, BARK	1400.00						700.00		10% SOLD, 90% BURNED
	HUNTSVILLE TIMBER PRODUCT	24	MUSKOKA	MARGE JENKINS	SAWDUST, SHAVINGS, END-CUTS	2080.00						1040.00		SUPPLIES DOMTAR INC.(HUNTSVILLE)
	KENT TRUSSES LIMITED.	24	PARRY SOUND	WILLIAM BROWNRIGG	SAWDUST, WOOD CHIPS					58.00		51.04		LANDFILLED
	KIMBERLY CLARK CANADA		MUSKOKA	MR. MONTGOMERY	PALLETS(DAMAGED)			5.00				4.00		LANDFILL AND FIREWOOD(EMPLOYEES)
	LA JAMBE FOREST PRODUCTS LTD.	24	PARRY SOUND	RENE CHATER	SAWDUST, BARK	364.00						182.00		SOLD AS FUEL, BEDDING, AND MEAT CURING
	MCRAE MILLS LTD.	24	NIPISSING	R. MCRAE	CHIPS,SAWDUST,BARK	11800.00						5900.00		BARK(BURNED),REST IS SOLD
	PARRY SOUND PALLET LTD.		PARRY SOUND	ED MAREK 705-746-5892	SAWDUST, END-CUTS									
	SOUTH RIVER PLANING MILLS INC.	24	PARRY SOUND	PAUL THOMPSON	SHAVINGS, END-CUTS	272.00						136.00		BAGS SHAVINGS TO SELL TO PUBLIC

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A	THOMPSON-HEYLAND LTD.	24	PARRY SOUND	JIM ALAN	SHAVINGS,SAWDUST					200.00		176.00		SOLD TO DOMTAR INC(HUNTSVILLE)
	WILBERFORCE PLANING MILL LTD.		RENFREW	ROBERT KLAPOW 705-448-2531	SAWDUST,SHAVINGS, END-CUTS	200.00						100.00		
REGIONAL TOTALS						26645.00		5.30		936.00		14150.42		
C	3K KITCHENS LTD.	24	DURHAM	J. KOKKINOS 416-294-5660	SAWDUST, END-CUTS					96.00		84.48		DISPOSAL COMPANY
	A&D WOOD PRODUCTS	24	NORTHUMBERLAND	ALEX MITCHELL 416-372-4689	SAWDUST, WOOD SHAVINGS, END-CUTS					54.33		47.81		FIREWOOD, LANDFILL
	A.G. SIMPSON COMPANY LTD.	34	METRO	GUS BEATON	PALLETS									DISPOSAL COMPANY
	A.R.C. INDUSTRIES	24	NIAGARA	W. KUCZMA 416-835-8211	END-CUTS, SAWDUST					0.70		0.62		FIREWOOD, BEDDING AND ABSORBENT
	A.R.C. INDUSTRIES	24	WATERLOO	T. TROWER 519-621-0680	SAWDUST, SHAVINGS, END-CUTS					3.00		2.64		END-CUTS SOLD AS FIREWOOD,REST LANDFILL
	A.R.C. INDUSTRIES	24	HAMILTON-WENTWORTH	MANAGER 416-545-8680	END-CUTS, SAWDUST					16.00		14.08		FIREWOOD,SAWDUST USED AS ABSORBENT,LNDFL

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C	A.R.C. INDUSTRIES	24	WELLINGTON	T. THOMPSON 519-824-7147	SHAVINGS, SAWDUST, END-CUTS									LANDFILL
	ACADIAN FRAME & WOODWORKING CO. LTD.	24	METRO	E. RUDERMAN	SAWDUST, END-CUTS					84.00		73.92		DISPOSAL COMPANY
	ACORN KITCHENS LTD.	24	WATERLOO	STANLEY H. SCOTT 519-893-6930	END-CUTS, SAWDUST					440.00		387.20		SAWDUST TO FARMERS, REST LANDFILLED
	ADAMS PACKAGING & MFG.		PEEL	A. HORNING 416-451-7671	SAWDUST, END-CUTS					45.00		39.60		LANDFILL AND SELL TO DOMTAR
	ADIAN MATERIAL HANDLING LTD.		YORK	WORDEN TEASDALE 416-252-4613	SAWDUST, WOOD SCRAPS					27.85		24.51		INCINERATE, LANDFILL, ANIMAL BEDDING
	ALLEN-BRADLEY CANADA LTD.	36	WATERLOO	W.E. METHERINGTON 519-623-1810	PALLETS			4.00				3.20		EMPLOYEES TAKE SOME WITH REST TO LANDFILL
	ALLISTON WOOD PRODUCTS		SIMCOE	KEITH CHANTLER 416-729-3169	SAWDUST, WOOD SCRAPS					6.30		5.54		BURNING ALL WOOD WASTE
	ALPA LUMBER INC.	24	YORK	G. PETTA 416-832-2250	END-CUTS					100.00		88.00		DISPOSAL COMPANY
	AMBER STAIRWAYS INC.	24	NIAGARA	ADRIAN BERMAN 416-935-2590	SAWDUST,END-CUTS, SHAVINGS,CHIPS					8.00		7.04		FARMERS, REST TO LANDFILL

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C	AMERICAN FRAME	24	METRO	J.T. CURNEW	END-CUTS AND SAWDUST					212.00		186.56		SAWDUST SOLD, END-CUTS SOLD AS FUEL
	APEX WOODWORKING COMPANY INC.	25	METRO	AARON HAILMON	SAWDUST,END-CUTS					7.50		6.60		DISPOSAL COMPANY
	ARROW-WOOD PLANNING MILLS	24	YORK	H. FOOT 416-881-6262	8 FT. STRIPS					160.00		140.80		LANDFILLED
	ARTISTIC WOODWORK CO. LTD.	24	PEEL	J. MOORE 416-890-1234	SAWDUST, END-CUTS					42.00		36.96		LANDFILL AND FIREWOOD,SAWDUST COLLECTED
	ATLANTIC PACKAGING PRODUCTS	26	METRO	R. NELSON	DAMAGED PALLETS			55.00				44.00		DISPOSAL COMPANY
	BAXTER CORPORATION	28	SIMCOE	HARRY RAMPAL	DAMAGED PALLETS			0.20				0.16		FIREWOOD
	BCE PUBLITECH INC.	27	YORK	A. PIKE 416-884-9121	PALLETS			1.00				0.80		DISPOSAL COMPANY
	BECKERMAN CUSTOM KITCHENS	24	WATERLOO	M. BECKERMAN 519-893-6280	SAWDUST, END-CUTS					40.00		35.20		SAWDUST TO FIRELOG CO.,REST LANDFILLED
	BICK'S PICKLES	20	METRO	GREG MERCER	PALLETS AND TOTE BOXES			0.50				0.40		VERY FEW DISPOSED OF,MOST REPAIRED

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C	BILTRITE NIGHTINGALE INC.	25	PEEL	HYE WEINBERG 416-896-3434	SAWDUST, END-CUTS					46.00		40.48		LANDFILLED
	BRITE MILLWORK LTD.	24	PEEL	LEN WHITE 416-857-6021	SAWDUST, SHAVINGS									CHIPBOARD PRODUCER(SAWDUST),LANDFIL L
	BRITTANIA WOOD MOULDING CO. LTD.	24	PEEL	D. BROWN 416-677-9204	SAWDUST					545.00		479.60		ALL GOES TO A FARMER
	BROWER WOOD PRODUCTS LTD.		YORK	ERIC BROWER 416-476-3422	SAWDUST, WOODCHIPS									ANIMAL BEDDING, USED TO MAKE CHIPBOARD
	BROWNER WOOD PRODUCTS	24	YORK	MR. ERIC BROWNER 416-476-3422	SAWDUST	175.00	210.00				105.00	87.50	197.40	FARMER, LANDFILL
	BUTLER-BAIRD LUMBER LTD.	24	YORK	BRIAN BUTLER 416-727-3074	SAWDUST,END-CUTS					15.50		13.64		FIREWOOD, INCINERATE, LANDFILL
	C & P WOODWORKING LTD.	25	METRO	JOS PANZA	CHIPBOARD					29.00		25.52		DISPOSAL COMPANY
	C.T.S. OF CANADA LTD.	36	PEEL	MANAGER 416-826-1141	PALLETS			5.00				4.00		PALLET RECYCLERS AND EMPLOYEES
	CANADA PACKERS	20	METRO	GEORGE KUROPAS	PALLETS			45.00				36.00		SUPERIOR PALLET SERVICE LTD.

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C	CANADIAN BUILDING SYSTEMS	24	HALTON	MIKE WEST 416-335-2000	SAWDUST,PACKING MATERIAL									SOLD TO EMPLOYEES
	CANADIAN PACIFIC RAILWAY		METRO	BILL KRESTINSKI	RAILWAY TIES									SOLD TO LANDSCAPERS, LANDFILLED,BURNED
	CANADIAN PORTABLE STRUCTURES LTD.	24	HALTON	HARRY SIPLE	SAWDUST, END-CUTS					32.00		28.16		DISPOSAL COMPANY
	CANNAUGHT LABRATORIES	28	METRO	P.J. CAMPBELL	PALLETS			0.50				0.40		DISPOSAL COMPANY
	CAPLECRAFT CABINETS LTD.	24	NIAGARA	HANS NEUFELD 416-688-5781	SHAVINGS, SAWDUST, END-CUTS					7.00		6.16		SHAVINGS/SAWDUST(FARMERS) ,LANDFILL
	CARR(DIV. OF TRW CAN. LTD)	36	BRANT	LARRY BIRCH 519-756-0420	SKIDS			1.00	1.50		0.75	0.80	0.66	GIVEN AWAY TO TRUCKING COMPANY,LANDFILL
	CENTURY KITCHENS INC.	24	BRANT	JOHN S. DOUGLAS 519-442-6301	SAWDUST, END-CUTS					42.00		36.96		LANDFILL
	CHEP CANADA INC		PEEL	JOHN WILSON 416-678-1372	WOOD SCRAPS					55.70		49.02		LANDFILL,
	CHERRY FOREST PROD. LTD.		WELLINGTON	EDWARD BARANSKI 519-763-1466	WOOD FIBRE	654.00						327.00		FARMERS,FUEL PELLETS,POTTING SOIL

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WOOD WASTE INVENTORY
DATABASE RECORDS : MANUFACTURING COMPANIES
PRODUCED FOR : MINISTRY OF THE ENVIRONMENT/MINISTRY OF ENERGY
(Waste Quantities (tonnes/month))

MNR REGION	NAME	SIC CODE	COUNTY/ REGION	CONTACT NAME PHONE NUMBER	WOOD WASTE CONDITION	AVG. RAW WOOD WASTE	MAX. RAW WOOD WASTE	AVG. AIR DRIED WOOD WASTE	MAX. AIR DRIED WOOD WASTE	AVG. OVEN DRIED WOOD WASTE	MAX. OVEN DRIED WOOD WASTE	AVG. BONE DRIED WOOD WASTE	MAX. BONE DRIED WOOD WASTE	CURRENT MANAGEMENT PRACTICE
C	CHRYSLER CANADA	23	DURHAM	M. KHOURY	PALLETS			200.00				160.00		RECYCLED
	COLONIAL WOOD PACKAGING INC.	24	BRANT	BILL BLANEY 519-756-8460	CUT-ENDS,SAWDUST									LANDFILL
	CONTINENTAL CAN CANADA LTD.	34	METRO	NICK KOUTAKIS	PALLETS			26.00				20.80		DISPOSAL COMPANY
	CORNEAU & SONS PALLET & BOX LTD.	24	SIMCOE	JIM CORNEAU 416-775-2463	SAWDUST, END-CUTS	54.70						27.35		ANIMAL BEDDING, FIREWOOD AND HEATING OF SITE
	CROYDON FURNITURE SYSTEMS INC.	25	WATERLOO	BILL HARDING 519-621-6300	PALLETS, END-CUTS					4.20		3.70		UNCOOPERATIVE
	CUSTOM WINDOWS LTD.	24	BRANT	WALTER HAMILTON 519-752-2547	WOOD CHIPS, END-CUTS, SAWDUST					185.00		162.80		SAWDUST/CHIPS(FARMER),FIR EWOOD
	CUSTOM WOOD FABRICATING CO. LTD.	24	METRO	SAM NILSTEIN	PLYWOOD, PARTICLEBOARD					91.00		80.08		DISPOSAL COMPANY
	D & E WOOD INDUSTRIES	24	DURHAM	MR. BROWN	SHAVINGS, CHIPS					1.50		1.32		LANDFILLED
	DAVEY LUMBER & BUILDING SUPPLIES	24	HAMILTON-WENTWORTH	MURRAY DAVIS 416-662-6359	END-CUTS, SAWDUST					1.00		0.88		FIREWOOD, SAWDUST(FARMER), LANDFILL
	DEILCRAFT FURNITURE	25	WATERLOO	TOM CALLAHAN	SHAVINGS,SAWDUST,	13.00				227.00		206.26		BURNS IN OWN UNIT FOR

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	CO. LTD.			519-893-6490	END-CUTS									HEATING
C	DIXIE WOODWORKS	24	PEEL	LUKE VAN DINTHER 416-270-7615	SAWDUST, END-CUTS					0.50		0.44		LANDFILL
	DOFASCO INC.	33	HAMILTON-WENTWORTH	MURRY CRANEFIELD 416-544-3761	BROKEN SKIDS, WOODEN CRATES			40.00				32.00		LANDFILL OR TO EMPLOYEES
	DOMINION WINDOWS	24	PEEL	H.L. HOPE 416-669-4340	END-CUTS,SAWDUST, SHAVINGS									HAMMER MILL GIVES TO BUTCHER SHOP
	DOMTAR INC.	26	PETERBOROUGH	SAM CLEMENTS	BARK, FIBRES	264.00						132.00		USED FOR BEDDING
	DON J. PESTELL LTD.	24	WATERLOO	DON PESTELL 519-622-2877	SHAVINGS									FARMERS
	ECO WOOD PROD.	24	YORK	MIKE THOMAS 416-669-4340	ALL WOOD WASTE RECYCLED					40.00		35.20		SELLS WOOD WASTE
	ELMIRA WOOD PRODUCTS	24	WATERLOO	MICHAEL J. COOK 519-669-1780	CHIPS, END-CUTS, SAWDUST					1.50		1.32		FARMER AND LANDFILL
	EMERY WOODWORKING	24	PEEL	M. SALOPEK 416-857-3117	SAWDUST, END-CUTS									FIREWOOD AND FARMERS, REST TO LANDFILL
	EMPIRE HEADBOARD CO. LTD.	25	METRO	MANAGER	SAWDUST, END-CUTS					15.00		13.20		MAJORITY OF WOODWASTE IS PURCHASED

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(Waste Quantities (tonnes/month))

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C	ERNST LEITZ OF CANADA	38	SIMCOE	JAMES ASELTINE	DAMAGED PALLETS									REUSED AS PALLETS OR USED AS FIREWOOD
	F.W. FEARMAN CO. LTD.	20	HALTON	WAYNE LENNOX 416-637-2301	BROKEN SKIDS			1.00	1.50			0.80	1.20	USED BY EMPLOYEES AS FIREWOOD
	FIBERGLASS CANADA INC.	32	WELLINGTON	E.W. MOGK 519-824-0120	SKIDS AND PACKING CRATES									EMPLOYEES TAKE WOOD HOME AS FIREWOOD
	FLECK MANUFACTURING INC.	36	METRO	MICHAEL BOCK	N/A									N/A
	FLEET AEROSPACE CORP. FLEET IND. DIVISION	37	NIAGARA	J.S. BUTYNIEC 416-871-2100	PALLETS,CRATES			10.00				8.00		LANDFILL
	FORD ELECTRONICS	37	YORK	EMMERICK SISCHECK 416-475-8510	PALLETS			25.00				20.00		DISPOSAL COMPANY
	FORMATOP MFG. CO. LTD	25	WATERLOO	HENRY REIDL 519-662-2800	END-CUTS, SAWDUST					29.00		25.52		LANDFILL
	GALAXY PALLET LTD.	24	NIAGARA	BRUCE MCFARLANE 416-957-3392	END-CUTS, SAWDUST, SHAVINGS									TAKEN AWAY AND SOLD BY ANOTHER PARTY
	GENERAL ELECTRIC CANADA INC.	36	HALTON	S. SNYDER/G. SMITH 416-849-2048	BROKEN SKIDS			5.00				4.00		LANDFILL

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C	GENERAL FOODS	20	NORTHUMBERLAND	JOHN SMITH	PALLETS			25.00				20.00		SOLD TO MARTIN WOOD PRODUCTS(TWEED)
	GENERAL MOTORS OF CANADA LTD.	37	DURHAM	BILL HOCKETT	PALLETS, DUNNAGE			455.00				364.00		USED TO FUEL HEATERS
	GLENHOLME PALLET CO.		DURHAM	STEVE FLARO 416-576-3011	SAWDUST, BAD WOOD, END-CUTS	49.00						24.50		ANIMAL BEDDING, LANDFILL
	GOLDCREST FURNITURE LTD.		METRO	DEBBIE LLOYD 416-789-4111	SAWDUST,END-PIECES					200.00		176.00		PURCHASED FOR INCINERATION
	GOLDEN WINDOWS LTD.	25	WATERLOO	L. BOLZAN 519-579-3810	END-CUTS, SAWDUST, SHAVINGS, CRATES					200.00		176.00		FARMER AND LANDFILL
	GREENSPOON BROTHERS		PEEL	PAUL GREENSPOON 416-458-1005	DEMOLITION WOOD			7500.00				6000.00		LANDFILL
	GUTHRIE CANADIAN INVESTMENTS LTD.	34	WATERLOO	J.W. ROBINSON 519-653-6286	BROKEN SKIDS			20.00				16.00		HARDWOOD FOR FIREWOOD BY EMPLOYEES,REST LANDFILLED
	H. & K. WOODWORKING LIMITED		YORK	L. SCHELL 416-294-3543	SAWDUST,END-CUTS, WOOD SCRAP	28.80						14.40		FIREWOOD COLLECTED BY PUBLIC, ANIMAL BEDDING
	H. ENGENESKI LUMBER LTD.	24	BRANT	HENRY ENGENSKI 519-446-2239	CHIPS, SAWDUST									FUEL,BEDDING, HEATING

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C	N.S. BARTRAM		HAMILTON-WENTWORTH	MR. JOHN COQUIUM 416-662-8931	END-PIECES,SAWDUST					14.60		12.85		LANDFILL
	HAMILTON MODULAR BUILDINGS INC.	24	BEAMSVILLE	ALEX VAUGH/TERRYSILIANNI 416-563-4984	END-CUTS,SAWDUST					1.00		0.88		FIREWOOD AND LANDFILL
	HAMMOND MANUFACTURING CO. LTD.	36	WELLINGTON	MANAGER 519-822-2960	WOODEN PALLETS,CRATES			6.00	8.00			4.80	6.40	EMPLOYEES TAKE WOOD HOME AS FIREWOOD
	HARLTON WOOD PRODUCTS INC.	24	WELLINGTON	SHARON PENDLETON 519-855-4460	END-CUTS,BROKEN BOARDS, SAWDUST					2.00		1.76		FIREWOOD,BEDDING
	HENRY SLATER & COMPANY LTD.	24	HAMILTON-WENTWORTH	CHARLIE WILKINSON 416-689-4813	BOARDS									FIREWOOD, HEATING
	HESPLER CRAFT IND. LTD.	24	WELLINGTON	AKHTAR M. SYED 519-658-5125	END-CUTS, SHAVINGS, SAWDUST					8.00		7.04		LANDFILL
	HILLMORE WOOD PRODUCTS	24	METRO	M. TRELLA	END-CUTS(HARDWOOD)					4.00		3.52		USED FOR FUEL IN SHOP
	HOME LUMBER COMPANY	24	METRO	GEORGE FRANKFURT	SAWDUST, END-CUTS					94.00		82.72		DISPOSAL COMPANY
	HONSBERGER LUMBER INC.	24	WATERLOO	DOUG HONSBERGER 519-743-4114	SAWDUST, END-CUTS									FIREWOOD, SAWDUST TO FARMERS

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C	NORNBY BOX AND PALLET(ACTON) LTD.	24	HALTON	CYBIL COOK/MARK GRENIER 519-853-1641	END-CUTS	54.50						27.25		FIREWOOD,FUEL,BEDDING
	HOUSE OF BROUGHAM LTD.		WELLINGTON	C. MEIER 519-836-3410	SAWDUST, WOOD CHIPS					28.00		24.64		LANDFILL
	HUDSON KITCHEN MFG. LTD.	24	YORK	J. URSINI 416-669-9947	SAWDUST, SHAVINGS									DISPOSAL COMPANY
	HUSSMANN STORE EQUIPMENT LTD.	35	BRANT	DOUG SNIDER 519-756-6351	SKIDS			0.50				0.40		LANDFILL AND EMPLOYEES USE FOR FIREWOOD
	IMASCO LTD.	21	WELLINGTON	MR. FLICK 519-824-4000	SKIDS			0.25				0.20		BROKEN SKIDS DISPOSED,OTHERWISE RETURNED
	INGLIS LTD.	36	WATERLOO	R.J. COLLINS-WRIGHT 519-623-4351	PALLETS			10.00				8.00		BROKEN SKIDS END UP AT THE LANDFILL
	INGLIS LTD.	36	PEEL	M. HIGGINS 416-278-3372	PALLETS			10.00				8.00		MAJORITY RECYCLED REST LANDFILLED
	INTERCRAFT IND. OF CANADA	24	PEEL	G. MINTON 416-275-3705	END-CUTS, SAWDUST					11.00		9.68		LANDFILLED
	INTERFOREST LTD.	24	DURHAM	LES KOVACS/GEORGE	DAMAGED VENEER									BURNED

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				WEIL										
C	J. ANDERSON SMITH CO.		DURHAM	JACK ADAMS	CHIPS , SHAVINGS									FARMERS FOR BEDDING
	J.E. THOMAS SPECIALTIES		PETERBOROUGH	MANAGER	END-CUTS					0.50		0.44		FIREWOOD(VERY SMALL AMOUNT)
	J.M. SCHNEIDER INC.	20	WATERLOO	JOHN E. LAUER 519-885-8100	PALLETS			0.50				0.40		SMALL AMOUNT OF WOOD GENERATED
	JAYDEN INC.		METRO	L.D. HOLMES	END-CUTS(PARTICLE BOARD)					1.00		0.88		DISPOSAL COMPANY(LANDFILLED)
	JOHN A. BIEWER(CANADA) LTD.	24	WATERLOO	R.W. BREWER 519-621-7701	SAWDUST, END-CUTS					5.00		4.40		SOME FIREWOOD, MOSTLY LANDFILLED
	JOHN DEERE LTD.	35	NIAGARA	RONNIE D. SONNENBURG 416-734-4501	WOODEN PALLETS			140.00				112.00		LANDFILL
	KARWALD IND.		PEEL	A. WEISMER 416-625-8452	END-CUTS,SAWDUST					580.00		510.40		LANDFILLED IN SUMMER,SOLD AS FUEL IN WIN
	KENLEIGH WOOD PRODUCTS INC.		METRO	KEN BEVERLEY 416-252-4615	SAWDUST,SHAVINGS, END-CUTS	25.00						12.50		
	KINGS SALE(DIV. KENANSON SALES LTD.)	24	BRANT	DENNIS KINGS 519-442-3029	SAWDUST,END-CUTS					20.50		18.04		BEDDING,FUEL

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C	KRUG FURNITURE INC.		WATERLOO	MANAGER 519-893-1100	PALLETS,END-PIECES			60.00				48.00		SCRAP COMANY AND LANDFILL
	LA-Z-BOY CANADA LTD.	25	WATERLOO	DON SCHOTT 519-886-3440	SHAVINGS					145.00		127.60		BURNING IN WINTER, SOME LANDFILL IN SUM.
	LAKE ONTARIO STEEL COMPANY	33	DURHAM	DOUG HOLTBY	DAMAGED PALLETS, DUNNAGE									N/A
	LAKE SCUGOG LUMBER	24	PETERBOROUGH	MR. GRIFFEN	END-CUTS					32.00		28.16		FIREWOOD AND LANDFILL
	LAM-WOODS PRODUCTS INC.	24	METRO	GORD WITTY	SAWDUST, END-CUTS					35.00		30.80		ALL BUT SAWDUST IS LANDFILLED
	LEVER BROTHERS LIMITED	28	METRO	R. V. POMROY	PALLETS			0.60	1.00			0.48	0.80	SUPERIOR PALLET SERVICE
	LIBERTY FURNITURE INDUSTRIES	25	YORK	A. OPRESNIK 416-669-2420	SAWDUST, END-CUTS, CHIPS					29.00		25.52		LANDFILLED
	LINAMAR MACHINE LTD.	35	WELLINGTON	MANAGER	VERY LITTLE WOOD WASTE									
	LITTLE "D" PRODUCTS	24	HAMILTON-WENTWORTH	STEVE DAVIDSON 519-623-6786	SAWDUST,SHAVINGS, CUT-ENDS					5.00		4.40		LANDFILL, BEDDING
	LITTLE FOLKS LTD.	25	WELLINGTON	W.J. MCCORKINDALE 519-846-5348	SAWDUST, END-CUTS					36.00		31.68		FARMER AND TO FUEL BOILER

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C	M.G. SLATER LUMBER	24	YORK	FLOYD KITE 416-727-9419	END-CUTS									LANDFILL AND SELLS SAWDUST AND SHAVINGS
	M.T.D. PRODUCTS LTD.	34	WATERLOO	J.C. HOMMEIER 519-579-5500	SKIDS			6.00				4.80		LANDFILLED
	MACMILLAN BATHURST	26	DURHAM	MANAGER	PALLETS			0.25				0.20		LANDFILLED
	MAPLEX DUNCNS WOOD PRODUCTS LTD.		YORK	MR. WILLIAM TENCER 416-832-0400	SHAVINGS, END-PIECES					104.00		91.52		FARMERS, LANDFILL , FIREWOOD
	MARKS LUMBER LTD.	24	BRANT	FRED MARKS 519-759-6070	CHIPS, END-CUTS, SAWDUST	455.00						227.50		FARMS(CHIPS/SAWDUST),FIRE WOOD,LANDFILL
	MASON WINDOWS	24	DURHAM	DOUG MASON	SAWDUST, END-CUTS					120.00		105.60		BEDDING(FARMER), LANDFILL
	MAURICE MILLER LUMBER LTD.	24	SIMCOE	DONALD MILLER	CHIPS, SHAVINGS, SAWDUST					57.00		50.16		LANDSCAPERS AND FARMERS
	McBRIDE LUMBER PRODUCTS		DURHAM	MR. JON E. TOPHAM 416-683-1008	SAWDUST,SHAVINGS, END-PIECES					180.00		158.40		FARMER,LANDFILL
	MCDONNEL DOUGLAS CANADA LTD.	37	PEEL	GARY KAPINSKI 416-677-4341	SKIDS,PACKING CRATES			55.00				44.00		LANDFILL
	MELLIER LUMBER CO. LTD.	24	NIAGARA	WILLIAM TARABA 416-892-2675	END-CUTS, SAWDUST, SHAVINGS					35.00		30.80		LANDFILL

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C	MERRILL WOOD INDUSTRIES		NORTHUMBERLAND	EARL MERRILL 705-653-2464	SAWDUST,TRIMMINGS, BAD LUMBER	48.00						24.00		
	MIDLAND BUILDALL	24	SIMCOE	R.F. BRAY	SAWDUST, END-CUTS					9.10		8.01		SAWDUST GIVEN TO FARMERS,GENERAL PUBLIC
	MITSUBISHI ELECTRONICS		SIMCOE	M. COLLIVER/E. MILLWARD	DAMAGED PALLETS,CRATES			0.25				0.20		EMPLOYEE WASTE PROGRAM
	MOLDEX	24	SIMCOE	A. CUNNINGHAM	DAMAGED PALLETS,SAWDUST			0.20				0.16		FIREWOOD, SAWDUST TAKEN TO LANDFILL
	MULTI-PALLET LTD.	24	PEEL	J. BELL 416-270-7901	END-CUTS, PALLETS, BOARDS			16.00				12.80		FIREWOOD,LANDFILL
	MURATA ERIE NORTH	36	PETERBOROUGH	F. NEWMAN	PALLETS			0.63				0.50		USED FOR STORAGE OR SHIPPING
	NATIONAL MILLWORK CO. LTD.	24	HALTON	WILLIAM KOHLER 416-335-5509	SHAVINGS, SAWDUST, END-CUTS					45.00		39.60		SHAVINGS/SAWDUST(FARMER) LANDFILL REST
	NEINKAMPER FURNITURE INC.	25	METRO	K. NEINKAMPER	SAWDUST, END-CUTS					14.50		12.76		DISPOSAL COMPANY
	NEWCO PREFAB CO.	24	DURHAM	MR. CARPINO	END-CUTS, SAWDUST, CHIPS AND SHAVINGS					96.00		84.48		USED IN A STEAM PLANT

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WOOD WASTE INVENTORY
DATABASE RECORDS : MANUFACTURING COMPANIES
PRODUCED FOR : MINISTRY OF THE ENVIRONMENT/MINISTRY OF ENERGY
(Waste Quantities (tonnes/month))

MNR REGION	NAME	SIC CODE	COUNTY/ REGION	CONTACT NAME PHONE NUMBER	WOOD WASTE CONDITION	AVG. RAW WOOD WASTE	MAX. RAW WOOD WASTE	AVG. AIR DRIED WOOD WASTE	MAX. AIR DRIED WOOD WASTE	AVG. OVEN DRIED WOOD WASTE	MAX. OVEN DRIED WOOD WASTE	AVG. BONE DRIED WOOD WASTE	MAX. BONE DRIED WOOD WASTE	CURRENT MANAGEMENT PRACTICE
C	NIAGARA RELOCATABLE BUILDINGS	24	NIAGARA	O. WERKMAN 416-945-9622	END-CUTS, SAWDUST					24.00		21.12		LANDFILL
	NOR-WILL MANUFACTURING CO. LTD.	25	METRO	HARRY SILVER	PARTICLE BOARD END-CUTS					65.00		57.20		DISPOSAL COMPANY
	NOUMAC ITCHENS	24	YORK	KLAUS BOGNER 416-889-1342	END-CUTS, SAWDUST									FARMERS, REST LANDFILLED
	OMARK CANADA LTD.	35	WELLINGTON	K. O. HAMMILL,GM 519-822-6870	SKIDS			3.00	5.00			2.40	4.00	TAKEN HOME BY EMPLOYEES
	ONTARIO PALLET LTD.	24	HALTON	BRENT SCHMIDT 416-878-8888	CUT-ENDS,SAWDUST									FIREWOOD,BEDDING
	ONTARIO STORE FIXTURES		YORK	MR. ENZO 416-749-8383	SAWDUST,SHAVINGS					10.00		8.00		FARMER,INCINERATE,RECYCLE
	ORLANDO LUMBER LTD.	24	NIAGARA	MARIA ORLANDO 416-732-3794	SAWDUST, END-CUTS									HEATING,BEDDING
	OUTBOARD MARINE CO.	35	PETERBOROUGH	JOHN MCCULLOUGH	PALLETS			7.50				6.00		DISPOSAL COMPANY
	PANNIL VENEER CO. LTD.	24	WATERLOO	A. SMITH 519-742-5887	BARK, SLABS, CHIPS, SAWDUST									BURNED AS FUEL IN BOILERS

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C	PAPERBOARD INDUSTRIES	26	PETERBOROUGH	D. ALEXANDER	PALLETS			10.00				8.00		LANDFILLED AND USED BY LOCALS FOR FUEL
	PARKINSON'S SAW MILL LTD.	24	WELLINGTON	J. F. PARKINSON	SLABS, SAWDUST, SHAVINGS									FIREWOOD(SLABS),SAWDUST/SHAVINGS(FARMER)
	PETER THOMPSON & SONS LTD.	24	SIMCOE	JOHN THOMPSON	SAWDUST, ENDS OF LOGS	18.00						9.00		FIREWOOD AND DISPOSAL COMPANY
	PHOENIX VENEERS LTD.	24	WELLINGTON	FRITZ KNICKMANN 519-323-3150	VENEER CHIPS, SAWDUST					18.00		15.84		LANDFILL
	PINEHURST WOODWORKING CO. LTD.	25	PEEL	J. REDEKOP 416-846-6001	SHAVINGS, SAWDUST, END-CUTS					35.00		30.80		FARMER TAKES SAWDUST/SHAVINGS,LANDFILL
	POLYDESIGNS	25	DURHAM	MR. STEEL	END-CUTS, SAWDUST					145.00		127.60		USED IN BOILER, SOLD TO MFG. OF PARTBRD
	POWEL CONTRACTING		YORK	BILL POWELL 416-884-2518	END-CUTS 8"X8" PIECES					0.15		0.13		GIVEN AWAY OR LANDFILLED
	PREMIER PALLET REPAIR CO.		PEEL	BOB BASCOM 416-671-4441	SAWDUST,END-CUTS, BROKEN BOARDS			52.80				42.24		
	QUALITEX KITCHENS INC.	24	YORK	M. LURCH 416-475-2573	SAWDUST, END-CUTS					400.00		352.00		DISPOSAL COMPANY

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C	R.J. MOORE HARDWOODS INC.	24	WATERLOO	R.J. MOORE 519-623-1991	SAWDUST, SHAVINGS, END-CUTS					55.00		48.40		FIREWOOD AND FARMERS(SAWDUST/SHAVINGS)
	RANDOMLANE IND. LTD.	24	YORK	WALTER COHEN 416-884-8159	SHAVINGS, END-CUTS									FARMERS AND LANDFILL
	RAYTHEON CANADA LTD.	38	WATERLOO	J.M. STEWART 519-885-0110	SKIDS			0.50				0.40		USED BY EMPLOYEES FOR FIREWOOD
	RAYWAL LTD.	24	YORK	DAVID LODU 416-889-6243	SAWDUST, CUT-ENDS									OFF SITE EFW
	ROCKETT LUMBER & BUILDING SUPPLIES	24	PEEL	N. LOPERS 416-275-1800	END-CUTS, SAWDUST					360.00		316.80		MOSTLY SOLD, REST LANDFILLED
	ROSEDALE FURNITURE	25	VICTORIA	PAUL SHOSENBERG	END-CUTS, SAWDUST, SHAVINGS					71.00		62.48		FARMER, OTHER WOOD WASTE STOCKPILED
	ROWNTREE MACKINTOSH CANADA LTD.	20	METRO	DAN FUOCO	PALLETS			0.50				0.40		SUPERIOR PALLET SERVICE LTD.
	ROYAL WOODWORKING CO. LTD.	24	YORK	RICK GERRITS 416-727-2755	SAWDUST, SHAVINGS, END-CUTS,PALLETS					20.00		17.60		FARMER(SHAVINGS),LANDFILL
	SANDERSON HAROLD CO. LTD.	24	BRANT	M. WOLFMAN 519-442-6311	END-CUTS, SAWDUST									LANDFILL, FARMERS AND FUEL

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C	SAWDUST PRODUCTS CO.	24	METRO	MR. FREEDMAN	USES OTHER COMPANIES WOOD WASTE IN MFG.									N/A
	SHUR-WAY INDUSTRIES INC.	24	WATERLOO	TOM SCHOTO 519-621-2077	SAWDUST, END-CUTS					116.00		102.08		SAWDUST TO FARMERS, REST LANDFILLED
	SHURWAY INDUSTRIES INC.	24	WATERLOO	MONTY OAKS 519-623-2380	SAWDUST, SHAVINGS, END-CUTS					87.00		76.56		SAWDUST/SHAVINGS(FARMER), FIREWOOD,LNDFLL
	SIMMONS LTD.	25	WELLINGTON	W. LAIDLAW 519-846-5321	SAWDUST, END-CUTS					0.50		0.44		MOSTLY SOLD WITH SMALL QUANTITY TO LNDFL
	SONNENBERG INDUSTRIES LTD.	24	METRO	GERHARD SONNENBERG	SHAVINGS									USED FOR FUEL DURING WINTER MONTHS
	SOUTHAM PRINTING LIMITED	27	METRO	GERRY LYNCH	PALLETS			12.50	25.00			10.00	20.00	DISPOSAL COMPANY
	ST. LEONARD'S PALLET CO.	24	BRANT	AL GOODWIN 519-759-8830	SAWDUST,BROKEN BOARDS, SHAVINGS,END-CUTS									BEDDING,FIREWOOD,LANDFILL
	STAIRCASE	24	HAMILTON-WENTWORTH	WILLIAM BUCHANAN 416-648-8890	END-CUTS, SAWDUST					18.00		15.84		SAWDUST(FARMER), LANDFILL
	STELCO STEEL HILTON WORKS	33	HAMILTON-WENTWORTH	MR. EISLER/MR. ADDLER 416-528-2511	CRATES,PALLETS, END-CUTS					55.00		48.40		EMPLOYEE PROGRAM FOR GOOD WOOD,REST LANDFILLED

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C	STRATHEARN HOUSE GROUP INC.	25	DURHAM	L.G. LOVE	SAWDUST, CHIPS					14.80		13.02		SOLD TO FARMER OR BURNED AS FUEL
	SUMARHAUSERMAN LTD.	25	WATERLOO	B. STOLTE 519-886-2000	CRATING, PALLETS									FIREWOOD(EMP), LANDFILL
	SUPREME WOODWORKING LTD.	24	METRO	J.T. CURNEW	SAWDUST, END-CUTS					22.00		19.36		DISPOSAL COMPANY
	SUTHERLAND-SHULTZ LTD.	34	WATERLOO	R.R. BROCK 519-743-4123	VERY LITTLE WOOD WASTE,MOSTLY REUSED					0.50		0.44		
	SWEDFURN CANADA	25	VICTORIA	PAUL SHOSENBERG	END-CUTS					5.00		4.40		WOOD USED FOR FIREWOOD(BOILER)
	TAMPA-HALL LTD.	24	WATERLOO	GEORGE P. ROTHWELL 519-632-7437	SAWDUST, END-CUTS					14.50		12.76		LANDFILL AND EMPLOYEES FOR FIREWOOD
	TEPERMAN		METRO	EARL GOTFRID 416-461-6161	DEMOLITION WOOD									LANDFILLED
	TEXACO CANADA INC.	29	METRO	C. WILD	PALLETS			0.50				0.40		VERY FEW DISPOSED OF AT THIS LOCATION
	THE NEW HARDING GROUP	22	SIMCOE	R. SCHUMAN	DAMAGED PALLETS					0.20		0.18		RETURNABLE OR USED FOR FIREWOOD

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C	THOMPSON PRODUCTS DIVISION	35	NIAGARA	MR. PAGENT 416-685-8411	SKIDS,CRATES			12.50				10.00		EMPLOYEES USE FOR FIREWOOD
	THREE J DISPLAY & WOODWORKING		METRO	JOHN MIKULA	SAWDUST, SHAVINGS					1.50	5.00	1.32	4.40	DISPOSAL COMPANY
	TIGER WRECKING LTD.		METRO	416-760-7000	DEMOLITION WOOD			6000.00				4800.00		RECYCLED AND LANDFILLED
	TORCHLIGHT IND./TORCHLIGHT SERVICES		WELLINGTON	KEITH LYMBURNER 519-822-7600	SAWDUST,END-CUTS					12.00		10.56		SAWDUST (FARMER),FIREWOOD,LANDFILL
	TORINO FURNITURE CO. LTD.	25	METRO	R. DELINO	SAWDUST, END-CUTS					7.00		6.16		DISPOSAL COMPANY
	TRILLIUM FOREST PROD. LTD.	24	YORK	M. SEMEREDY/AL MCLELLAN 416-738-1341	SAWDUST,END-CUTS					140.00		123.20		FIREWOOD,SELLS SAWDUST,LANDFILLS REST
	TWIN WINDOWS INC.	24	BRANT	L. REPAR 416-877-9332	SAWDUST, END-CUTS					12.50		11.00		SAWDUST(FARMER),KINDLING AND LANDFILL
	UNION CARBIDE CANADA LTD.	36	NIAGARA	MR. BUCHANAN 416-732-6121	PALLETS			1.50				1.20		EMPLOYEES USE FOR FIREWOOD,OWN LANDFILL
	UNIROYAL GOODRICH	30	WATERLOO	KENNETH J. MACDONALD	PALLETS, CRATES			40.00				32.00		LANDFILL DISPOSAL

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	CANADA			519-894-7800										
C	VAN WART BUILDING SUPPLIES	24	PEEL	B. LAPLANTE 416-678-1121	SAWDUST, END-CUTS					45.00		39.60		LANDFILL
	VANGUARD MOLDINGS INC.	24	METRO	CYRIL KEEPING	SAWDUST, END-CUTS					55.00		48.40		DISPOSAL COMPANY
	VILLARO IND.	25	YORK	R. KNAPP 416-479-2554	END-CUTS, SAWDUST					290.00		255.20		DISPOSAL COMPANY
	WALKER EXHAUSTS(DIV. OF TENNECO CANADA INC)	37	WATERLOO	TREVOR HUNT 519-621-3360	SKIDS, PACKING CRATES			0.50				0.40		ALL USED FOR FIREWOOD BY EMPLOYEES
	WELLINGTON WOOD PRODUCTS LTD.	24	WELLINGTON	KEN HINCKS 519-323-1060	END-CUTS SAWDUST					18.00		15.84		BURN IN WINTER LANDFILL IN SUMMER
	WILLARD G. HALLMAN LUMBER LTD.	24	WATERLOO	MARK HALLMAN	SAWDUST, BARK, CHIPS	545.00						272.50		BEDDING, LANDSCAPING, FUEL PELLETS
	WOODBRIDGE LUMBER	24	YORK	G. DIPOCE 416-851-2804	SAWDUST,END-CUTS					29.00		25.52		LANDFILLED
	ZIGMUND BLOSKI LUMBER	24	WATERLOO	ZIGMUND BLOSKI	SAWDUST, BARK	300.00						150.00		

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REGIONAL TOTALS						2684.00	210.00	14867.18	42.00	6969.43	110.75	19368.85	234.86	
E	A.E.C.L.	28	OTTAWA-CARLETON	R. GILMOUR	PALLETS, SAWDUST, END-CUTS					1.40		1.23		DISPOSAL COMPANY
	ADAMS & KENEDY		OTTAWA-CARLETON	ART ADAMS	SHAVINGS, SAWDUST, WOOD TRIM									BEDDING, AND 85% FOR FUEL, 15% LANDFILL
	ALBERT LAROUQUE LUMBER	24	PRESCOTT & RUSSELL	F. LAROQUE	BARK,SAWDUST,CHIPS	1636.00						818.00		MOSTLY SOLD, LANDFILLED IF NO BUYER
	ALEXANDRIA MOULDING	24	STORMONT & DUNDAS	M. THIEBEAULT	BARK, END-CUTS,STICKS	910.00						455.00		ALL WASTE MATERIAL IS SOLD
	AMOCO FABRICS	22	PRESCOTT & RUSSELL	LES MURDOCH	PALLETS			0.10				0.08		RETURN/RECYCLE/EMPLOYEES
	BAGEWOOD LUMBER LTD.	24	PRESCOTT & RUSSELL	NAOM BAUMAN	CHIPS, SAWDUST,BARK	530.00						265.00		WOOD PELLETS, CHIPS TO IKO BRAMPTON
	BLACK & DECKER	35	LEEDS & GRENVILLE	M. GARDINER	PALLETS			20.00				16.00		35% LANDFILLED, 65% USED FOR FUEL
	BRAUN WOOD APPLICATION	24	HASTINGS	BOB SCTIIRKA	PARTICLEBOARD WITH UREAFORMELDEHYDE					128.00		112.64		LANDFILLED

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E	BROCKVILLE COMMUNITY WORKSHOP	24	LEEDS & GRENVILLE	J. KENN	SAWDUST, SHAVINGS, END-CUTS					4.00		3.52		WOOD WASTE IS SOLD
	CAPITAL ROOF TRUSS	24	OTTAWA-CARLETON	B. KONYK	SAWDUST, END-CUTS, PALLETS					74.00		65.12		DISPOSAL COMPANY
	CELANESE CANADA INC.		FRONTENAC	G. WHITEMAN	PALLETS			0.63				0.50		UTILIZED BY FIRE DEPT AND CONSTRUCTION
	CONTROL DATA CANADA	38	OTTAWA-CARLETON	MR. DEWAR	PALLETS			0.13				0.10		EMPLOYEES USE FOR FIREWOOD
	COOPER LUMBER LIMITED		PRINCE EDWARD	HERB COOPER 613-393-2877	SAWDUST,SHAVINGS, BLOCKS,TRIM BLOCKS									FIREWOOD,ANIMAL BEDDING, OWN LANDFILL
	COURTAULDS	28	STORMONT & DUNDAS	MR. HARWOOD	PALLETS, WOOD SCRAPS					0.28		0.25		DISPOSAL COMPANY
	D. KEMP EDWARDS	24	OTTAWA-CARLETON	M. EDWARDS	SAWDUST, SHAVINGS									USED FOR FUEL, INCINERATED
	DOMINION TEXTILE	22	STORMONT & DUNDAS	G. LARGY	PALLETS			2.00				1.60		RECYCLED INTERNALLY OR EMPLOYEES
	DOMINION TEXTILE	22	STORMONT & DUNDAS	B. SPENSER	PALLETS			0.20				0.16		RECYCLED INTERNALLY OR DISPOSED LNDFILL
	DOMTAR INC	26	STORMONT & DUNDAS	L. MILLWARD	BARK,PULP	1773.00						886.50		LANDFILLED IN PRIVATE AND

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					REJECTS,PALLETS,ORGANIC FIBRE									MUNICIPAL LDF
E	DUPONT CANADA	28	LEEDS & GRENVILLE	MR. ROBINSON	DAMAGED PALLETS					1.00		0.88		DISPOSAL COMPANY WITH SOME BEING SOLD
	E.B. EDDY	26	OTTAWA-CARLETON	C. MCCULLOUGH	PAPERMILL SLUDGE	363.00						181.50		DISPOSAL COMPANY
	ELBERSTEIN INDUSTRIES	24	FRONTENAC	MR. MARQUARDT	SAWDUST, SHAVINGS					97.20		85.54		GIVEN TO FARMERS AS BEDDING FOR ANIMALS
	GENERAL PALLET LTD.		LEEDS & GRENVILLE	SAM MARINI 613-692-4396	BROKEN PALLETS, ODD SIZE PALLETS									INCINERATE FOR HEATING,FIREWOOD
	GIBBARD FURNITURE SHOP	25	OTTAWA-CARLETON	J. MCPHERSON	END-CUTS, SHAVINGS, SAWDUST									USED FOR ON-SITE HEATING
	GREAT NORTHERN APPAREL	23	STORMONT & DUNDAS	P. BARKER	PALLETS			1.00				0.80		RECYCLED INTERNALLY
	HELKO FURNITURE SYSTEMS	25	STORMONT & DUNDAS	R. SEQUIN	PALLETS, END-CUTS									DISPOSAL COMPANY WITH PALLETS REUSED
	IROQUOIS ENTERPRISES LTD.		STORMONT & DUNDAS	LES CRAIG 613-652-4854	SAWDUST,END-CUTS, BROKEN BOARDS,CHIPS	794.22						397.11		
	J.R. MENARD LTD. -ST. ISIDARE DE	24	PRESCOTT & RUSSELL	J.R.MENARD	SHAVINGS, END-CUTS, PALLETS	168.00						84.00		SOLD

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MNR REGION	NAME	SIC CODE	COUNTY/ REGION	CONTACT NAME PHONE NUMBER	WOOD WASTE CONDITION	AVG. RAW WOOD WASTE	MAX. RAW WOOD WASTE	AVG. AIR DRIED WOOD WASTE	MAX. AIR DRIED WOOD WASTE	AVG. OVEN DRIED WOOD WASTE	MAX. OVEN DRIED WOOD WASTE	AVG. BONE DRIED WOOD WASTE	MAX. BONE DRIED WOOD WASTE	CURRENT MANAGEMENT PRACTICE
	PRESCOT													
E	K. GUTMAN INC.	25	STORMONT & DUNDAS	MR. MUELLER	SAWDUST,END-CUTS									DISPOSAL COMPANY
	K.O. MANUFACTURING	24	FRONTENAC	PETER SCHMIDT	SAWDUST, END-CUTS					305.00		268.40		BEDDING/HEATING, SCRAPS LANDFILLED
	KEN LYNWOOD CO. LTD.		HASTINGS	KENNETH STAPLEY 613-966-2209	END-PIECES					10.00		8.80		LANDFILL OR WORKERS TO BURN IN WINTER
	KEN MACLENNAN SAWMILL	24	PRESCOTT/RUSSELL	J. RENWICK	ALL BY-PRODUCTS SOLD									N/A
	KRAFT LTD.		STORMONT/DUNDAS	I. SAWATSKY	PALLETS			1.00				0.80		DISPOSAL COMPANY
	L'ORIGNAL FEEDS & SAWMILL	24	PRESCOTT & RUSSELL	P. LALONDE	SHAVINGS, SAWDUST, BARK LUMBER	21.00						10.50		SOLD FOR BEDDING OR FUEL
	LANARK CEDAR	24	OTTAWA-CARLETON	S. LOUGH	SHAVINGS,SLABWOOD,BARK,END-CUTS,SAWDUST	133.00						66.50		MOST WOOD WASTE IS SOLD
	LAURYSEN KITCHENS	24	OTTAWA-CARLETON	JIM GRENIER	SAWDUST, MELAMINE PARTICLE BOARD					4.70		4.14		DISPOSAL COMPANY
	LENNOX SNOW FENCE		LENNOX & ADDINGTON	PHIL MOORE	BARK AND SHAVINGS, FENCE SLATS	0.30						0.15		LANDFILL IN OWN YARD OR BURN IN YARD
	MARTIN WOOD PRODUCTS	24	HASTINGS	P. WEMP	SHAVINGS,SAWDUST,	306.00						153.00		FIREWOOD,FARMERS AND

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PRODUCED FOR : MINISTRY OF THE ENVIRONMENT/MINISTRY OF ENERGY
(Waste Quantities (tonnes/month))

MNR REGION	NAME	SIC CODE	COUNTY/ REGION	CONTACT NAME PHONE NUMBER	WOOD WASTE CONDITION	AVG. RAW WOOD WASTE	MAX. RAW WOOD WASTE	AVG. AIR DRIED WOOD WASTE	MAX. AIR DRIED WOOD WASTE	AVG. OVEN DRIED WOOD WASTE	MAX. OVEN DRIED WOOD WASTE	AVG. BONE DRIED WOOD WASTE	MAX. BONE DRIED WOOD WASTE	CURRENT MANAGEMENT PRACTICE
					END-CUTS,PALLETS									LANDFILL
E	McNERNEY WOODWORKING		FRONTENAC	MIKE 613-479-2711	SAWDUST, END-PIECES					12.00		10.56		INCINERATE,LANDFILL
	MITEL CORP.	36	OTTAWA-CARLETON	B. CROFT	PALLETS			0.05				0.04		DISPOSAL COMPANY
	NESTLE ENTERPRISES		STORMONT & DUNDAS	J. CUMMINGS	PALLETS			1.00				0.80		DISPOSAL COMPANY
	NOREWOOD INDUSTRIES		STORMONT/DUNDAS	DALE MURDOCH	END-CUTS					28.00		24.64		DISPOSAL COMPANY
	NORTHERN TELECOM	36	FRONTENAC	F. BAYNO	PALLETS, DUNNAGE			20.00				16.00		MOSTLY LANDFILLED, EMPLOYEES FIREWOOD
	ONTARIO TRUSS AND WALL	24	HASTINGS	F. SHORTT	SAWDUST, END-CUTS									BURNT IN YARD
	PROCTOR & GAMBLE	26	HASTINGS	MR. SHIELDS	PALLETS			0.25				0.20		FIREWOOD (90%) LANDFILL (10%)
	ROYAL CANADIAN MINT	39	OTTAWA-CARLETON	ROY YOGASINGHAM	PALLETS, CHIPS, END-CUTS					2.50		2.20		RETURN AND LANDFILL PALLETS
	SOUTHAM INC.	27	OTTAWA-CARLETON	J. MCGEE/R. BUCK	PAPER WASTE ONLY									RECYCLED AS INSULATION
	SUPERIOR ROOF TRUSS		OTTAWA-CARLETON	PAUL BURN 613-822-8787	KILN MILLED					34.00		29.92		LANDFILL

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E	TRADITION WINDOWS	24	STORMONT & DUNDAS	G. BOUGIE	END-CUTS									REUSE WOOD IN WINDOW CONSTRUCTION
	XL WOOD PRODUCTS LTD.		STORMONT/DUNDAS	ZENON GELLNER 613-525-4504	SAWDUST, END-CUTS, BROKEN BOARDS	240.10						120.05		
REGIONAL TOTALS						6874.62		46.36		702.08		4092.23		
NE	HAMPEK-GIBSON FOREST PRODUCTS	24	NORTH BAY	MR. GIBSON	SHAVINGS, BARK, SAWDUST	542.00	666.00					271.00	333.00	USED FOR FILL IN ROADS AND PROPERTY
	LAIDLAW-GOODWOOD	24	NORTH BAY	M. CLARK	HOGGED WOOD					410.00		360.80		EITHER SOLD TO DOMTAR OR USED FOR FUEL
REGIONAL TOTALS						542.00	666.00			410.00		631.80	333.00	
SW	A.R.C. INDUSTRIES	24	HURON	HARRY STUART	SAWDUST, SHAVINGS, END-CUTS									FIREWOOD AND SHAVINGS SOLD TO FARMER
	ACCURIDE CANADA INC.	37	MIDDLESEX	A.G. BROWN	PLYWOOD SHEETS, DAMAGED PALLETS									SHEETS PICKED UP BY CONTRACTORS
	ACTIVE MOULD &		ESSEX	LORIS BRESOLIN						0.18		0.16		

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	DESIGN(1977) LTD.			519-737-1341										
SW	ADM AGRI-INDUSTRIES LTD.		ESSEX							0.01				
	AGGREGATE RECYCLING		ESSEX	MANAGER	LUMBER					34.53		30.39		LANDFILL
	ARBOR DOMINION LTD.		ESSEX	P.S. SETHI 519-966-0350				0.91				0.73		
	ARNOLD MANUFACTURING LTD.	25	ESSEX	J. WOOD	SAWDUST, END-CUTS					2.00		1.76		DISPOSAL COMPANY
	BASF COATINGS & INKS CANADA LTD.		ESSEX	T. RYAN 519-256-3155				10.91				8.73		
	BYWAY LUMBER	24	PERTH	MR. CARD	BARK/CHIPS, SAWDUST	16.00	20.00					8.00	10.00	BARK IS LANDFILLED, SAWDUST SOLD(BEDDING)
	CANADIAN A.S.E. LTD.		ESSEX	MURRAY CHEVALIER 519-944-8007				0.01				0.01		
	CANADIAN FABRICATED PRODUCTS	30	PERTH	ALEXANDER RENNIE	PALLETS									SOLD
	CHRYSLER PLANTS #2, #3, #6		ESSEX	MANAGER	PALLETS			269.01				215.21		LANDFILL

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SW	CLEVITE INDUSTRIES LTD.	37	ELGIN	W. JONES	PALLETS (DAMAGED)			0.25				0.20		DISPOSAL COMPANY
	COLONIAL TOOL TEXTRON		ESSEX	IAN REID 519-253-2461				1.82				1.46		
	CONTINENTAL CABINET CO. INC.	24	MIDDLESEX	BILL VOLK	SAWDUST, SHAVINGS, END-CUTS					0.35		0.31		DISPOSAL COMPANY
	DIFFRACTO LTD.		ESSEX	MARTY BAUER 519-945-6373				0.36				0.29		
	DOMINION FORGE COMPANY LTD.		ESSEX	VINCE ADKAR 519-254-7545						0.09				
	DOMINION WATERBED INC.	25	MIDDLESEX	L.A. MIBOURG	SAWDUST, SHAVINGS, END-CUTS					0.13		0.11		LANDFILL AND FIREWOOD
	DUOMATIC OLSEN		ESSEX	CHRIS RIXEN 519-682-2062				0.73				0.58		
	EASTERN MANUFACTURING	24	ESSEX	DENIS BEAULIEU 519-977-9556	SAWDUST									LANDFILL
	ECAMR -ARC INDUSTRIES	24	ESSEX	J. LASSALINE	SAWDUST, SHAVINGS, KINDLING									BEDDING,SOLD,IF BIN FILLED THEN DUMPED

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SW	ELGIN MANOLES LTD.	24	ELGIN	JOHN TADEMA	SAWDUST, SHAVINGS, END-CUTS									SAWDUST/SHAVINGS(FARMS),FIREWOOD
	ERIC JAMES LTD.		ESSEX	NORMAN VILLEGAS 519-326-4417				1.68				1.34		
	ERIE WOOD PRODUCTS LTD.	24	ELGIN	JOHN ROLOSON 519-773-3856	SAWDUST,SLAB WOOD, SHAVINGS									BEDDING,FIREWOOD
	FABRICATED STEEL LTD.		ESSEX	MANAGER	PALLETS			20.27				16.22		LANDFILL
	FELDMAN WINDOW MFG. LTD.	24	KENT	J. MARANCIE	SHAVINGS, END-CUTS					56.00		49.28		SHAVINGS USED FOR ANIMAL BEDDING,LNDFILL
	FINDLAY PALLET CO. LTD.	24	GREY	RON FINDLAY 519-363-3011	SHAVINGS,SAWDUST, END-CUTS									FIREWOOD,BEDDING
	FORD ESSEX ENGINE PLANT		ESSEX	F.D. TAYLOR 519-944-8710	PALLETS			19.40				15.52		LANDFILL
	FORD MOTOR CO. CAN. LTD. -CASTING PLANT	33		T. SCHLOTZ	PALLETS			200.00				160.00		DISPOSAL COMPANY
	FORD MOTOR CO. CAN. LTD. -TRIM PLANT	33		D. CAMPBELL	PALLETS			50.00				40.00		SOLD OR DISPOSAL COMPANY

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SW	FORD PLANT #5		ESSEX	MANAGER	PALLETS			24.80				19.84		LANDFILL
	FRIENDCO ENTERPRISES	24	ELGIN	W.T. BALDSON	SAWDUST,SHAVINGS, END-CUTS					0.14		0.12		FIREWOOD,SHAVINGS SOLD,SAWDUST DUMPED
	GENERAL CHEMICAL CANADA LTD.		ESSEX	R. LEPING 519-736-2111				18.00				14.40		
	GENERAL MOTORS OF CANADA		ESSEX	F.J. VAN DER PUTT 519-255-4180				0.80				0.64		
	GM TRANSMISSION PLANT		ESSEX	MANAGER	PALLETS			383.35				306.68		LANDFILL
	HEYME WOOD PRODUCTS LTD.	24	ESSEX	A. WIGGINS	SAWDUST,END-CUTS (PARTICLEBOARD)					12.00		10.56		LANDFILLED
	HIRAM WALKER & SONS LTD.		ESSEX	R.G.ALDI 519-254-5171										
	HURON STEEL PRODUCTS		ESSEX	BRUCE ASHTON 519-254-2841				0.91				0.72		
	I.T.T. MERIT		ESSEX	G. DUFFY 519-966-5191				1.08				0.86		
	INDAL LTD.	34	ESSEX	R. CHANKO	PALLETS			20.00				16.00		DISPOSAL COMPANY

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SW	INDUSTRIAL PALLETS LTD.	24	KENT	MARCEL BAEYENS 519-627-4449	END-CUTS,SHAVINGS, SAWDUST	0.50						0.25		BEDDING,FIREWOOD
	INDUSTRIAL REHAB. WORKSHOPS	25	MIDDLESEX	JOHN MUIR	SAWDUST, END-CUTS					0.20		0.18		DISPOSAL COMPANY
	J.H. KEESO & SONS LTD.	24	PERTH	HAROLD KEESO	SAWDUST,SLAB WOOD, SOME BARK	4741.00						2370.50		BEDDING,FIREWOOD,DISPOSAL COMPANY
	JAS GORDON & SONS LTD.	24	HALDIMAND-NORFOLK	JIM GORDON 416-765-2736	SAWDUST,SHAVINGS, END-CUTS					10.90		9.59		BEDDING,FUEL
	KENDAN MANUFACTURING KTD.		ESSEX	JIM PROCTOR				3.00				2.40		
	KINGSVILLE FISHERMENS CO. LTD.		ESSEX	CARL FRASER 519-733-6534				0.72				0.58		LANDFILLED
	LIBBEY ST.CLAIR INC.	32	KENT	S. GRANGER	PALLETS			4.00						EMPLOYEES OR REFURBISHER
	MACDERMID INVESTMENTS	24	LAMBTON	ALAN EASTMAN 519-876-5380	SAWDUST, END-CUTS					215.00		189.20		BEDDING,FIREWOOD
	MORELLO MANUFACTURING	24	PERTH	LOUIS MORELLO 519-348-8993	SAWDUST,END-CUTS					35.40		31.15		LANDFILL,FIREWOOD,BEDDING
	NORMAN A FAUCNER	24	ESSEX	N. FAUCNER	WOOD SCRAPS, SAWDUST					9.00		7.92		MOST SOLD FOR FIREWOOD &

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	LTD.													BEDDING, LNDFIL
SW	NORTHLANDER INDUSTRIES	24	HURON	JIM BEDARD	SAWDUST,END-CUTS					28.20		24.82		LANDFILLED
	NORTHSTAR PALLET CO.	24	MIDDLESEX	DON MATTHEWS 519-652-2463	SAWDUST,END-CUTS, BROKEN BOARDS			100.00				80.00		FIREWOOD,LANDFILL
	OLINDA FOODS INC.		ESSEX	R. CORNIES 519-322-2881				0.72				0.58		LANDFILLED
	OLSONITE COMPANY LTD.	24	KENT	L. OLSEN	BROKEN PALLETS			5.00				4.00		DISPOSAL CONTRACT
	OMSTEAD FOODS LTD.	24	KENT	R. STEINGART	PALLETS,TOTE BOXES			2.60	5.20					EMPLOYEES OR DISCARDED WITH OCC WASTE
	ONTARIO CABINET MAKERS		ESSEX	MANAGER	LUMBER					29.49		25.95		LANDFILL
	POLYSAR LTD.		LAMBTON	D. COX	PALLETS, SCAFFOLDS, CRATES			3.00				2.40		LANDFILLED, EMPLOYEES USE WOOD FOR FIREWOOD
	PORT ELGIN CABINETMAKERS LTD.	24	BRUCE	ARNY MITTENDORF	SAWDUST, SHAVINGS, END-CUTS									SAWDUST BOUGHT BY FARMERS,REST LANDFILL
	PRIMO FOODS LTD.		ESSEX	E. QURESHI 519-839-4857				9.72				7.78		LANDFILLED

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SW	QUALIPACK WOOD PRODUCTS LTD.		ESSEX	R. CLAVETTE	SAWDUST, END-CUTS					235.00		206.80		ANIMAL BEDDING, FIREWOOD, LANDFILLED
	QUALITY SAFETY SYSTEMS COMPANY		ESSEX	CLAUS BACHER 519-973-7400				0.18				0.14		
	R.J. CYR CO. INC.		ESSEX	RANDY CYR, PRESIDENT 519-737-6194	WASTE WOOD					0.18		0.16		
	R.J. DUNGEY & SONS LIMITED	24	PERTH	JOHN DUNGEY 519-348-8477	SHAVINGS,BARK,SAWDUST, SLAB WOOD									BURNS MOST,LANDFILLS SOME
	RBW GRAPHICS	27	GREY	B. CLARK	PALLETS AND CRATES					10.00		8.80		CRATES(FIREWOOD),PALLETS(REFURBISHER)
	READY BAKE FROZEN DOUGH INC.		ESSEX	DOUG POUNDING 519-776-7334				0.90				0.72		
	REFLEX DIV. OF I.T.L. IND. LTD.		ESSEX	JANICE JONES 519-969-9611				2.00				1.60		
	RKH WOOD PRODUCTS LTD.	24	BRUCE	RON HODGINS	SAWDUST, CHIPS, BARK, END-CUTS									SOLD TO FARMERS AND LANDSCAPERS,FUEL
	ROCKWELL INTERNATIONAL OF CAN. LTD.		ESSEX	DON KENDRICK 519-682-1740						130.00	114.40			

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SW	ROSS WOOD PRODUCTS	24	ESSEX	LARRY ROSS 519-322-2620	SAWDUST, BROKEN BOARDS									FIREWOOD, LANDFILL
	ROYAL HOMES LTD.	24	HURON	DOUG PENSON	SAWDUST,END-CUTS					54.00		47.52		LANDFILL
	S.K.D. COMPANY	37	ESSEX	R. BADIUK	NIL					0.10		0.09		
	SELINGER WOOD LTD.	24	HURON	ROBERT SELINGER	SAWDUST, END-CUTS					15.50		13.64		FIREWOOD
	SOMMERVILLE PACKAGING	26	MIDDLESEX	D.R. McREADY	NO WOOD WASTE									
	SOUTHERN WOOD PRODUCTS LTD.	24	LAMBTON	P. BIEMAN	SAWDUST, END-CUTS					90.00		79.20		BEDDING FIREWOOD(80%EMP.,20%PLANT)
	STANDARD INDUCTION CASTINGS		ESSEX	KEN MILLER 519-253-2446				0.55				0.44		
	STANLEY KNIGHT(MEAFORD) INC.	24	GREY	GERRY S. KNIGHT	SAWDUST, SHAVINGS, CHIPS					340.00		299.20		FUELWOOD
	STRATHEARN HOUSE GROUP LTD.	25	HURON	P. CRESWELL	SAWDUST, SHAVINGS					14.80		13.02		FIREWOOD, SAWDUST TO FARMERS, LANDFILL
	SUN BRITE CANNING LTD.		ESSEX	HENRY IACOBELLI 519-326-9033				3.60				2.88		

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PRODUCED FOR : MINISTRY OF THE ENVIRONMENT/MINISTRY OF ENERGY
(Waste Quantities (tonnes/month))

MNR REGION	NAME	SIC CODE	COUNTY/ REGION	CONTACT NAME PHONE NUMBER	WOOD WASTE CONDITION	AVG. RAW WOOD WASTE	MAX. RAW WOOD WASTE	AVG. AIR DRIED WOOD WASTE	MAX. AIR DRIED WOOD WASTE	AVG. OVEN DRIED WOOD WASTE	MAX. OVEN DRIED WOOD WASTE	AVG. BONE DRIED WOOD WASTE	MAX. BONE DRIED WOOD WASTE	CURRENT MANAGEMENT PRACTICE
SW	T.D.S. LIMITED	24	MIDDLESEX	FRANK PENZ	PALLETS, END-CUTS									PALLETS GIVEN AWAY,FIREWOOD OR LANDFILL
	TEAL MFG. (WINDSOR) LTD.		ESSEX	JOHN LOT 519-737-6901				0.91				0.73		
	THE CANADIAN SALT COMPANY LTD.		ESSEX	GRANT SUTHERLAND 519-972-2207				0.18				0.14		LANDFILLED
	THE MILNER-RIGBY CO. LTD.	24	ELGIN	RAY JOBSON	SAWDUST,END-CUTS, SHAVINGS	464.00						232.00		SAWDUST&SHAVINGS SOLD,BURN IN BOILER
	THE SEAGRAM COMPANY LTD.		ESSEX	WILLIAM MORE				1.58				1.26		LANDFILLED
	THE WINDSOR STAR		ESSEX	C.J. SABUTSCH 519-255-5777				9.90				7.92		
	TIMBERJACK INC	35	OXFORD	R. HARWOOD	PALLETS									EMPLOYEES FOR FIREWOOD
	TREND MILLWORK & CABINETS LTD.	24	ESSEX	D. BAXTER	SAWDUST,END-CUTS					20.00		17.60		END-CUTS LANDFILLED,SAWDUST SOLD
	VME EQUIPMENT OF CAN. LTD.	35	ELGIN	R.L. GILBERT	PALLETS,CRATES									FIREWOOD(CRATES),LANDFILL (PALLETS)
	WAYNE CANADA		ESSEX	RANDY SMITH				28.80				23.04		

C = Central Region; SW = SouthWestern Region; E = Eastern Region; NC = NorthCentral Region; NE = NorthEastern Region; A = Algonquin Region

WOOD WASTE INVENTORT
DATABASE RECORDS : MANUFACTURING COMPANIES
PRODUCED FOR : MINISTRY OF THE ENVIRONMENT/MINISTRY OF ENERGY
(Waste Quantities (tonnes/month))

MNR REGION	NAME	SIC CODE	COUNTY/ REGION	CONTACT NAME PHONE NUMBER	WOOD WASTE CONDITION	AVG. RAW WOOD WASTE	MAX. RAW WOOD WASTE	AVG. AIR DRIED WOOD WASTE	MAX. AIR DRIED WOOD WASTE	AVG. OVEN DRIED WOOD WASTE	MAX. OVEN DRIED WOOD WASTE	AVG. BONE DRIED WOOD WASTE	MAX. BONE DRIED WOOD WASTE	CURRENT MANAGEMENT PRACTICE
				519-972-1700										
SW	WINDSOR MATCH PLATE & TOOL LTD.		ESSEX	RANDY REAUME 519-945-6371				14.40				11.52		
	WINDSOR PLASTIC PRODUCTS LTD.		ESSEX	PRESTON PUNGA 519-944-5445				21.82				17.46		
	ZOLLNER CANADA LTD.		ESSEX	R.L. STOCKWELL 519-326-2654				0.27				0.22		
	ZURICH WOOD PRODUCTS LTD.	24	HURON	RAY MCKINNON 519-236-4324	PALLETS									SAWDUST, END-CUTS
REGIONAL TOTALS						5221.50	20.00	1238.14	5.20	1343.20	114.40	4663.52	10.00	
SUMMARY TOTALS						45851.12	896.00	16165.48	68.20	10653.01	225.15	45112.85	594.66	

C = Central Region; SW = SouthWestern Region; E = Eastern Region; NC = NorthCentral Region; NE = NorthEastern Region; A = Algonquin Region

APPENDIX C

This appendix contains the quantities per month in bone dry tonnes of wood waste according to the categories shown for the Ministry of Natural Resources regions and districts.

27/07/89

WOOD WASTE INVENTORY
DATABASE RECORDS : MNR DISTRICTS
PRODUCED FOR : MINISTRY OF THE ENVIRONMENT/MINISTRY OF ENERGY
(Waste Quantities (tonnes/year))

REGION	DISTRICT	SAWDUST WASTE QUANTITIES	SHAVINGS WASTE QUANTITIES	HOGFUEL WASTE QUANTITIES	BARK WASTE QUANTITIES	BONE DRY WASTE QUANTITIES
ALGONQUIN	BRACEBRIDGE	7376.00	886.00		2945.00	5603.50
	ALGONQUIN PARK	54968.00	20192.00		68412.00	71786.00
	PARRY SOUND	10738.00			7726.00	9232.00
	BANCROFT	31272.00	877.00		25188.00	28668.50
	PEMBROKE	24845.00			59604.00	42224.50
	MINDEN	4157.00		1461.00	4913.00	5265.50
REGIONAL TOTALS		133356.00	21955.00	1461.00	168788.00	162780.00
CENTRAL	HURONIA	1327.00			1101.00	1214.00
	CAMBRIDGE	5688.00		3588.00	4872.00	7074.00
	LINDSAY	2047.00			1689.00	1868.00
	MAPLE	2698.00			419.00	1558.50
	NIAGARA				73183.00	36591.50
REGIONAL TOTALS		11760.00		3588.00	81264.00	48306.00
EASTERN	NAPANEE	5035.00	569.00	500.00	7512.00	6808.00
	TWEED	4344.00	420.00		6489.00	5626.50
	CARLETON PLACE	2220.00			6626.00	4423.00

WOOD WASTE INVENTORY
DATABASE RECORDS : MNR DISTRICTS
PRODUCED FOR : MINISTRY OF THE ENVIRONMENT/MINISTRY OF ENERGY
(Waste Quantities (tonnes/year))

REGION	DISTRICT	SAWDUST WASTE QUANTITIES	SHAVINGS WASTE QUANTITIES	HOGFUEL WASTE QUANTITIES	BARK WASTE QUANTITIES	BONE DRY WASTE QUANTITIES
EASTERN	BROCKVILLE	277.00			224.00	250.50
	CORNWALL	3532.00	4021.00		10314.00	8933.50
REGIONAL TOTALS		15408.00	5010.00	500.00	31165.00	26041.50
NORTHCENTRAL	NIPPISING	209.00			155.00	182.00
	GERALDTON	145.00			108.00	126.50
	ATIKOKAN	1443.00		78.00	542.00	1031.50
	TERRACE BAY				116170.00	58085.00
	THUNDER BAY	2259.00	360.00	12035.00	30494.00	22574.00
REGIONAL TOTALS		4056.00	360.00	12113.00	147469.00	81999.00
NORTHEASTERN	BLIND RIVER	8519.00			1456.00	4987.50
	NORTH BAY	13815.00	2114.00	5702.00	18755.00	20193.00
	WAWA	24360.00			27889.00	26124.50
	ESPANOLA	924.00			736.00	830.00
	SAULT STE. MARIE	2624.00	4024.00		2836.00	4742.00
	SUDBURY	17756.00	200.00		17681.00	17818.50
	TEMAGAMI	37.00			3153.00	1595.00

WOOD WASTE INVENTORY
DATABASE RECORDS : MNR DISTRICTS
PRODUCED FOR : MINISTRY OF THE ENVIRONMENT/MINISTRY OF ENERGY
(Waste Quantities (tonnes/year))

REGION	DISTRICT	SAWDUST WASTE QUANTITIES	SHAVINGS WASTE QUANTITIES	HOGFUEL WASTE QUANTITIES	BARK WASTE QUANTITIES	BONE DRY WASTE QUANTITIES
REGIONAL TOTALS		68035.00	6338.00	5702.00	72506.00	76290.50
NORTHERN	GOOGAMI	13.00			100.00	56.50
	KIRKLAND LAKE	57324.00		14221.00	64918.00	68231.50
	KAPUSKASING	143.00	45.00		101.00	144.50
	TIMMINS	1047.00		41408.00	29886.00	36170.50
	HEARST	9142.00	2103.00		2.00	5623.50
	CHAPLEAU	5845.00	12081.00	122.00	6942.00	12495.00
REGIONAL TOTALS		73514.00	14229.00	55751.00	101949.00	122721.50
NORTHWESTERN	SIOUX LOOKOUT	30687.00	43165.00		65008.00	69430.00
	RED LAKE	2120.00	542.00		1452.00	2057.00
	IGNACE	4160.00			30930.00	17545.00
	PORT FRANCES	10354.00	556.00		4859.00	7884.50
	DRYDEN	406.00				203.00
	KENORA	5119.00	1506.00		3581.00	5103.00
REGIONAL TOTALS		52846.00	45769.00		105830.00	102222.50

WOOD WASTE INVENTORY
DATABASE RECORDS : MNR DISTRICTS
PRODUCED FOR : MINISTRY OF THE ENVIRONMENT/MINISTRY OF ENERGY
(Waste Quantities (tonnes/year))

REGION	DISTRICT	SAWDUST WASTE QUANTITIES	SHAVINGS WASTE QUANTITIES	HOGFUEL WASTE QUANTITIES	BARK WASTE QUANTITIES	BONE DRY WASTE QUANTITIES
SOUTHWESTERN	AYLMER				3255.00	1627.50
	CHATHAM	1131.00			1560.00	1345.50
	SIMCOE	2359.00			2003.00	2181.00
	OWEN SOUND	5678.00			5329.00	5503.50
	WINGHAM	9168.00				4584.00
REGIONAL TOTALS		18336.00			12147.00	15241.50
SUMMARY TOTALS		377311.00	93661.00	79115.00	721118.00	635602.50

Source: Ontario Forest Industry Statistical Reports for 1986, MNR

Note: Data has been updated to reflect 1987 records by MNR Staff

APPENDIX D

Table D.1 summarizes wood waste inventory data according to Ministry of Natural Resources regions.

TABLE O 1

INVENTORY SUMMARY BY REGION

(bone dry tonnes per month)

MNR REGION	INVENTORY ACTIVITY	AVG RAW WOOD WAST	MAX RAW WOOD WAST	AVG. AIR DRY WOOD	MAX. AIR DRY WOOD	AVG. OVEN DRY WOOD	MAX. OVEN DRY WOOD	AVG. BONE DRY WOOD	MAX. BONE DRY WOOD
ALGONQUIN	CONSERVATION AREAS	1.58	2.38					0.79	1.19
	MANUFACTURING COMPANIES	26645.00		5.30		936.00		14150.42	
	MUNICIPALITIES	30.50	60.50					15.25	30.25
	WASTE MANAGEMENT								
	PROVINCIAL PARKS	0.22						0.11	
	TOTAL	26677.30	62.88	5.30	0.00	936.00	0.00	14166.57	31.44
CENTRAL	CONSERVATION AREAS	31.28	35.45					15.65	17.73
	MANUFACTURING COMPANIES	2684.00	210.00	14867.18	4.20	6969.43	110.75	19368.85	234.86
	MUNICIPALITIES	5445.30	2825.17	2040.50	300.75	2910.25		5283.09	1412.58
	WASTE MANAGEMENT	1045.00				2519.00	165.00	2739.22	145.20
	PROVINCIAL PARKS	6.20	6.13					3.11	3.06
	TOTAL	9211.78	3076.75	16907.68	304.95	12398.68	275.75	27409.92	1813.43
EASTERN	CONSERVATION AREAS	1.90	1.82					0.95	0.91
	MANUFACTURING COMPANIES	6874.62		46.36	300.75	702.08		4092.00	
	MUNICIPALITIES	1674.80	1614.60					837.40	807.30
	WASTE MANAGEMENT					68.20		600.16	
	PROVINCIAL PARKS	7.27	20.00					3.64	10.00
	TOTAL	8558.59	1636.42	46.36	300.75	770.28	0.00	5534.15	818.21
SOUTHWESTERN	CONSERVATION AREAS	3.91	2.89					1.97	1.44
	MANUFACTURING COMPANIES	5221.50	20.00	1238.14	5.20	1343.20	114.00	4663.52	10.00
	MUNICIPALITIES	718.67	1284.00					359.33	642.00
	WASTE MANAGEMENT	24.00				19.50		29.16	
	PROVINCIAL PARKS	28.65	80.00					14.32	40.00
	TOTAL	5996.73	1386.89	1238.14	5.20	1362.70	114.00	5068.30	693.44
NORTHEASTERN	CONSERVATION AREAS	5.00						2.50	
	MANUFACTURING COMPANIES	542.00	666.00			410.00		631.80	333.00
	MUNICIPALITIES								
	WASTE MANAGEMENT								
	PROVINCIAL PARKS								
	TOTAL	547.00	666.00	0.00	0.00	410.00	0.00	634.30	333.00
UNASSIGNED REGIONS	CONSERVATION AREAS								
	MANUFACTURING COMPANIES	3884.00		8.50	21.00	292.30		2206.03	16.80
	MUNICIPALITIES								
	WASTE MANAGEMENT					450.00		396.00	
	PROVINCIAL PARKS								
	TOTAL	3884.00	0.00	8.50	21.00	742.30	0.00	2602.03	16.80